SOCIO-ECONOMIC DYNAMICS OF SANITATION IN THE INFORMAL SETTLEMENTS OF KISUMU CITY, KENYA

By

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DECLARATION

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ABSTRACT

Countries are experiencing a surge in the number of people living in urban areas. A majority of the poor in these urban areas live in informal settlements, which face challenges such as inadequate sanitation. There thus is a need to understand why informal settlements lack sanitation facilities, as well as a need for approaches that can be used to increase access. Kisumu, the third largest city in Kenya, also hosts informal settlements that have inadequate sanitation facilities. Little is known about aspects within these settlements that influence sanitation. The goal of this study was to examine socio-economic dynamics in Kisumu's informal settlements, and how they interact to influence access to and the management of sanitation. The main objectives were to describe living conditions in the settlements, to estimate the cost of sanitation from rental prices, to investigate determinants of shared sanitation quality, and to investigate decision-making for sanitation within the settlements. The study began with a quantitative phase, which was built on by a qualitative phase. A cross-sectional survey was conducted during the quantitative stage, while multiple case study designs and participatory research with concepts from action/transdisciplinary research were adopted in the subsequent qualitative phase. Respondents were residents of the settlements as well as stakeholders involved in sanitation. The results show that residents lack basic services such as sanitation. Residents living in compounds with absentee landlords often had poor housing, lacked basic services, and paid lower rents compared to those in compounds with live-in landlords. Sanitation facilities constituted 54% of rental prices, but willingness to pay a higher amount of rent declined when the number of households sharing sanitation facilities increased. Most sanitation facilities were shared by an average of eight households, and from inspection, 64% of these facilities were dirty. They were more likely to be dirty as the number of households sharing them increased. Reasons for dirty shared sanitation facilities were investigated using the common pool resource management principles, which showed that facilities were likely to be clean when there was a defined user group that collectively made decisions and had a defined management structure that made it easier to resolve conflicts and work together to keep sanitation facilities clean. Regarding decision making, landlords often made investment decisions, while tenants made decisions related to cleaning, often after consultations. At the community and city level, residents identified sanitation challenges within their settlements and proposed solutions to the identified challenges. The results indicate that sanitation in informal settlements is highly complex and is entrenched in residents' daily lives. Most quantitative models lead to an understanding of measurable physical factors, but socio-economic factors such as relationships, beliefs, practices and norms equally influence access to and management of sanitation facilities. Efforts at improvement ought not to concentrate on provision only, but also on strategies to keep the provided facilities in a proper condition that enables sustained use. Stakeholders, including policy makers, should embrace working together for the common good.

Keywords: *sanitation, informal settlements, shared sanitation, decision making, transdisciplinary research, payment for sanitation, hedonic pricing, living conditions, socio-economic dynamics, landlord, tenant, common pool resource management principles, Kisumu*

OPSOMMING

Lande ervaar 'n toename in die getal mense wat in stedelike gebiede woon. 'n Meerderheid van die armes in hierdie stedelike gebiede woon in informele nedersettings, wat uitdagings ervaar soos onvoldoende sanitasie. Daar is dus 'n behoefte om te verstaan hoekom informele nedersettings 'n gebrek aan sanitasiefasiliteite het, sowel as 'n behoefte aan benaderings wat gebruik kan word om toegang te verbeter. Kisumu, die derde grootste stad in Kenia, het ook informele nedersettings wat nie voldoende sanitasiefasiliteite het nie. Min is bekend oor die aspekte binne hierdie nedersettings wat sanitasie beïnvloed. Die doelwit van hierdie studie was om ondersoek in te stel na die sosio-ekonomiese dinamika in Kisumu se informele nedersettings, en hoe hulle op mekaar inwerk om toegang tot en die bestuur van sanitasie te beïnvloed. Die vernaamste doelwitte was om die lewensomstandighede in die nedersettings te beskryf, om die koste van sanitasie op grond van huurpryse te skat, om die determinante van die kwaliteit van gedeelde sanitasie te ondersoek, en om ondersoek in te stel na besluitneming oor sanitasie binne die nedersettings. Die studie het begin met 'n kwantitatiewe fase, waarop 'n kwalitatiewe fase gebou is. 'n Deursnee opname is tydens die kwantitatiewe fase uitgevoer, terwyl veelvuldige gevallestudie-ontwerpe en deelnemende navorsing met konsepte vanuit aksie-/transdissiplinêre navorsing in die gevolglike kwalitatiewe fase opgeneem is. Die respondente was inwoners van die nedersettings sowel as belanghebbers betrokke by sanitasie. Die resultate toon dat die inwoners nie basiese dienste soos water en sanitasie gehad het nie. Inwoners wat in gebiede gewoon het met afwesige huiseienaars het in baie gevalle swak behuising en geen basiese dienste gehad nie, en het minder huur betaal as dié in gebiede waar die huiseienaars ook gewoon het. Sanitasiefasiliteite het 54% van die huurkoste uitgemaak, maar hul bereidwilligheid om meer huur te betaal het afgeneem soos die getal huise wat die sanitasiefasiliteite deel, toegeneem het. Die meeste sanitasiefasiliteite is deur 'n gemiddeld van agt huishoudings gedeel, en vanuit die inspeksie hiervan was 64% van hierdie fasiliteite vuil. Daar was 'n groter kans dat hulle vuil was hoe meer huishoudings die fasiliteite gedeel het. Die redes vir vuil gedeelde sanitasiefasiliteite is ondersoek deur gebruik te maak van die *common pool resource management principles*, wat aangedui het dat die fasiliteite moontlik skoon sou wees waar daar 'n gedefinieerde gebruikersgroep was wat gesamentlik besluite geneem het en wat 'n gedefinieerde bestuurstruktuur gehad het wat dit makliker gemaak het om konflik op te los en om saam te werk om die sanitasiefasiliteite skoon te hou. Met betrekking tot besluitneming, het huiseienaars gereeld beleggingsbesluite geneem, terwyl die huurders besluite oor skoonmaak geneem het, in baie gevalle ná konsultasie. Op die gemeenskaps- en stadsvlak het inwoners sanitasie-uitdagings in hulle nedersettings geïdentifiseer en oplossings vir die geïdentifiseerde uitdagings voorgestel. Die resultate toon dat sanitasie in informele nedersettings baie kompleks is en in die inwoners se daaglikse lewens verskans is. Die meeste kwantitatiewe modelle lei tot 'n begrip van meetbare fisiese faktore, maar sosio-ekonomiese faktore soos verhoudings, geloof, praktyke en norme het 'n gelyke invloed op toegang tot en bestuur van sanitasiefasiliteite. Pogings tot verbetering moet nie net op voorsiening fokus nie, maar ook op strategieë om die verskafde fasiliteite in 'n ordentlike toestand te hou wat volgehoue gebruik moontlik maak. Belanghebbers, insluitend beleidmakers, moet met genoeë saamwerk vir die algemene welsyn.

Sleutelwoorde: *sanitasie, informele nedersettings, gedeelde sanitasie, besluitneming, transdissiplinêre navorsing, betaling vir sanitasie, hedoniese prysbepaling, lewensomstandighede, sosio-ekonomiese dinamika, huiseienaar, huurder,* common pool resource management principles*, Kisumu*

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ABM	Attribute-based methods
AFD	French Agency for Development
AIDS	Acquired immune deficiency syndrome
BCC	Behaviour change communication
CBD	Central business district
CBO	Community-based organisation
CE	Choice experiments
CLTS	Community-led Total Sanitation
CPR	Common pool resource
CV	Contingent valuation
DFID	Department for International Development
EHP	Emergency Housing Programme
FGD	Focus group discussion
GIS	Geographical information systems
GLUK	Great Lakes University of Kisumu
HIV	Human immunodeficiency virus
HPM	Hedonic pricing method
JMP	Joint Monitoring Program
KENSUP	Kenya Slum Upgrading Programme
KES	Kenyan Shilling
KISIP	Kenya Informal Settlements Improvement Project
KIWASCO	Kisumu Water and Sanitation Company
KNBS	Kenya National Bureau of Statistics
KSSP	Kumasi Strategic Sanitation Project
KUAP	Kisumu Urban Apostasy Project
KUP	Kisumu Urban Project
KVIP	Kumasi Ventilated Improved Pit Latrine
KWAHO	Kenya Water and Health Organisation
MDG	Millennium Development Goal
NACOSTI	National Commission for Science, Technology and Innovation
NCPD	National Council for Population and Development
NEMA	National Environmental Management Authority

NGO	Non-governmental organisation
NIE	New Institutional Economics
NSP	Non-state providers
OPP	Orangi Pilot Project
OPP-RTI	Orangi Pilot Project – Research and Training Institute
RDP	Reconstruction and Development Programme
REC	Research and Ethics Committee
RP	Revealed preference
SANA	Sustainable Aid in Africa
SDG	Sustainable Development Goal
SECODE	Sustainable Environment and Community Development
SHARE	Sanitation and Hygiene Applied Research for Equity
SIDA	Swedish International Development Agency
SNOWS	Scientists Networked for Outcomes from Water and Sanitation
SP	Stated preference
SSA	Sub-Saharan Africa
SSD	Social Science for Development
SSIP	Small-scale independent providers
TdR	Transdisciplinary research
TfD	Theatre for Development
TICH	Tropical Institute of Community Health
UDDT	Urine diversion and dehydrating toilet
UN	United Nations
UN-HABITAT	United Nations Human Settlements Program
UNICEF	United Nations Children's Fund
USD	United States dollars
Vif	Variance Inflation Factor
VIP	Ventilated improved pit latrines
VND	Viet Nam Dong
WB	World Bank
WHO	World Health Organization
WTP	Willingness to pay
ZAR	South African rand

CHAPTER 1: INTRODUCTION

1.1 Background to the study

1.1.1 The current discourse in world development

The period of the Millennium Development Goals (MDGs) closed in 2015, and 2016 marks the beginning of the Sustainable Development Goals (SDGs) period. The SDGs are seventeen goals aimed at ending poverty, protecting the planet and ensuring prosperity for all. Of particular interest to this dissertation is SDG 6, which aims to ensure access to water and sanitation for all, and SDG 11, which aims to make cities inclusive, safe, resilient and sustainable[1]. Most of these goals have been carried over from the MDGs, as some MDG targets were not met by the end of the MDG period. Since the SDG period is just beginning, this dissertation will refer to the just concluded MDG period and statistics.

During the MDG period it was observed that the world was experiencing rapid urbanisation, and that half of the world's population now lives in cities (UN-Habitat, 2013:25). One of the effects of urbanisation is the growth of informal settlements, and by 2012, it was projected that worldwide, approximately 863 million people lived in informal settlements (United Nations, 2014:46). These settlements are faced with a number of challenges, but of particular interest to this dissertation is sanitation, of which the target at the close of the MDG period (compared to water) was far from being met.

1.1.2 Trends in sanitation coverage

The Joint Monitoring Program (JMP) of the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) was mandated to keep track of progress in the water and sanitation target of the seventh MDG. The JMP uses a four-step 'sanitation ladder' to classify sanitation, as shown in Table 1.1. During the MDG period it was highlighted that there was a general increase in the number of people with access to improved sanitation. Other interesting observations on trends in sanitation coverage were also made during the period:

- Between 1990 and 2012, the population in urban areas without access to improved sanitation increased from 541 million to 756 million (WHO & UNICEF, 2014:26).

[1] From the United Nations SDG website (http://www.un.org/sustainabledevelopment/water-and-sanitation/)

Table 1.1: The JMP sanitation ladder

Unimproved sanitation	**Open defecation** Human faeces are disposed of in fields, forests, bushes, open bodies of water, beaches/other open spaces, or disposed of with solid waste.
	Unimproved sanitation facilities Do not ensure hygienic separation of human excreta from human contact. They include pit latrines without a slab or platform, hanging latrines and bucket latrines.
	Shared sanitation facilities Sanitation facilities of an otherwise acceptable type shared between two or more households. Only facilities that are not shared or not public are considered improved.
Improved sanitation	**Improved sanitation facilities** Ensure hygienic separation of human excreta from human contact. They are: • Flush/pour flush to: - Piped sewer system - Septic tank - Pit latrine • Ventilated improved pit (VIP) latrine • Pit latrine with slab • Composting toilet

Source: UNICEF & WHO, 2015

- By 2015, approximately 2.4 billion people lacked improved sanitation facilities, with the lowest coverage being in Southern Asia and in Sub-Saharan Africa (SSA) (UNICEF & WHO, 2015) as shown in figure 1.1. In SSA particularly, where approximately 695 million people lacked improved sanitation, the increase in access to sanitation has not kept up with population growth (UNICEF & WHO, 2015).

The high use of unimproved sanitation facilities in Africa and Asia may suggest that demand for improved sanitation is on the rise in these regions (Mara, Lane, Scott & Trouba, 2010). Nevertheless, with the increasing rates of urbanisation and the high number of people without access to sanitation in urban areas, it is important to understand *who* lacks sanitation in the urban areas, *why* they lack sanitation, *what* can be done about it, and *how* it can be done.

In this attempt to understand the 'who', 'why', 'what' and 'how' it becomes critical to also establish areas of greatest need, or areas *where* sanitation is lacking in urban areas. Informal settlements are areas in urban centres characterised by poverty, a lack of basic urban services such as safe water and sanitation, tenure insecurity,

substandard housing, and overcrowding (UN-Habitat, 2003a, 2014; Davis, 2006; Cranby, 2012; Nuissl & Heinrichs, 2013; Harris, 2014).

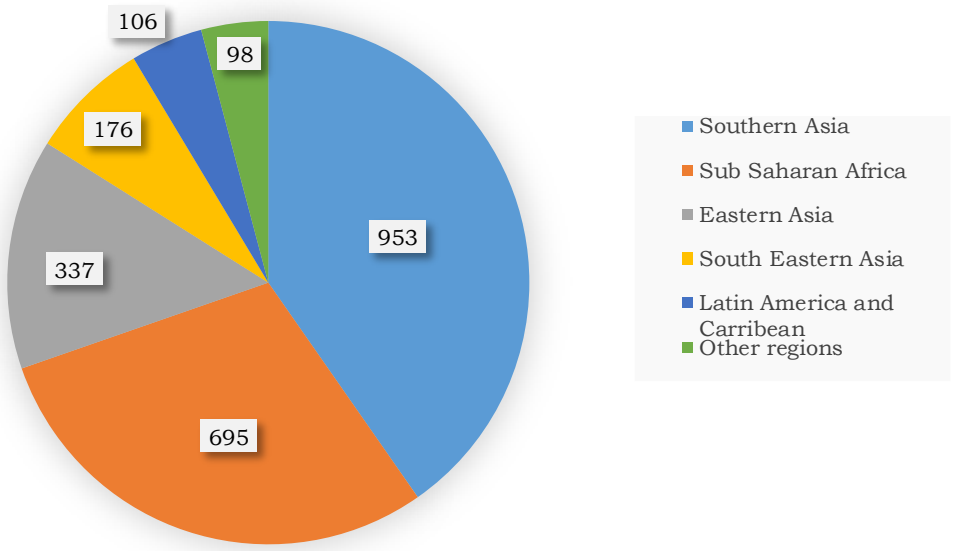

Figure 1.1: Regional estimates of population without improved sanitation by 2015

NB: Figures are in millions. Source: adapted from UNICEF &WHO, 2015.

Lack of sanitation is one defining characteristic of informal settlements, especially in Africa (UN-Habitat, 2003a, 2014:31; Davis, 2006; Cranby, 2012; Nuissl & Heinrichs, 2013), and, as such, the poor people living in these settlements contribute significantly to the high number of people without access to improved sanitation in urban areas. However, the 2015 JMP report acknowledges the insufficiency of data from informal settlements and highlights the need for more work to monitor access and gather sanitation data from such areas (UNICEF & WHO, 2015). As the SDG period sets off, the sanitation target of the sixth SDG is to "achieve access to adequate and equitable sanitation and hygiene for all, and end open defecation, with attention being given to the needs of women, girls and those in vulnerable situations"[2]. Given the inadequacies of measuring what is defined as improved by the JMP, Satterthwaite (2016), for example, suggests that research on the SDG target for water and

[2] From the United Nations SDG website, http://www.un.org/sustainabledevelopment/water-and-sanitation/

sanitation needs to include aspects of quality, reliability, access and cost, with attention being given to differences in context between urban and rural areas. In Kenya, for instance, where this study was conducted, only 31% of the urban population has access to improved sanitation (UNICEF & WHO, 2015), yet 60 to 80% of the urban population lives in informal settlements (Syrjänen, 2008). A starting point for the SDG period would be to understand why residents of informal settlements lack sanitation and what can be done about it. Perhaps another question would be, what is adequate and equitable especially in informal settlements, given the insufficiency of data?

Achieving adequate sanitation in informal settlements is complex and requires an understanding of various aspects, including identifying the most appropriate sanitation technology, funding/financing for sanitation, challenges of land tenure, challenges of sharing sanitation facilities, operation and maintenance aspects at the lowest (household) level, and socio-cultural aspects that determine feasibility and acceptability (Mara, Drangert, Anh & Tonderski, 2007; Isunju, Schwartz, Schouten, Johnson & van Dijk, 2011; Lüthi, Panesar, Schütze, Norström, McConville, *et al.*, 2011). Okurut and Kulabako (2015) also highlight that sanitation has not received the priority it deserves because socio economic benefits have either not been recognised or not communicated appropriately. These socio-economic aspects collectively explain the lack of sanitation, determine adequacy and equitability, and thus call for rigorous research approaches in informal settlements. For instance, Mara *et al.* (2010), note that although governments have built sanitation infrastructure as one approach to increasing access to sanitation, the focus is shifting to helping people improve their own sanitation and change their behaviour. An understanding of the relevant socio-economic dynamics of sanitation in informal settlements could contribute to such people-focused improvement; a focus that could also be adopted in the Kenyan context.

1.2 Problem statement

In Kenya, the burgeoning of informal settlements as a result of urban population growth is a challenge to socio-economic development (NCPD, 2013). These informal settlements occur in most cities in the country, such as Nairobi, Kisumu and Mombasa. Kisumu is estimated to have the highest proportion of residents living in informal settlements (NCPD, 2013), with estimates ranging from between 47 and 60 percent (Syrjänen, 2008; NCPD, 2013).

These residents in Kisumu's informal settlements are faced with challenges common to informal settlements, such as poverty, poor housing and a lack of basic services (UN-Habitat, 2005; NCPD, 2013). There is, however, a dearth of sanitation statistics on the settlements, although studies suggest high levels of inadequate sanitation (UN-Habitat, 2005; Huchzermeyer, 2009; Karanja, 2010; Cage, 2014; Letema, Van Vliet & Van Lier, 2014), with an indication that approximately half of the residents in the settlements lack sanitation facilities (Karanja, 2010). Lack of sanitation has been documented to have public health consequences through the spread of sanitation related diseases such as diarrhoea (Mara *et al.*, 2010), with children in poor urban areas being at greater risk of morbidity and mortality from these diseases (Rheingans, Cumming, Anderson & Showalter, 2012). Provision of sanitation, therefore, improves the health status of the population through reduction of morbidity and mortality from sanitation related diseases (Wolf, Prüss-Ustün, Cumming, Bartram, Bonjour, *et al.*, 2014). Access to sanitation further leads to time savings and general economic improvement (Hutton, Haller & Bartram, 2007; Luṯhi *et al.*, 2011; WHO, 2012).

Provision of sanitation would therefore benefit residents of Kisumu's informal settlements. However, provision efforts may first need to understand socio economic dynamics within the settlements which could play a role in the inadequacy of sanitation. Previous studies include little (if any) revelation of socio-economic aspects and how these aspects influence access to and management of sanitation. Some of these aspects include conditions within the informal settlements, economic aspects of sanitation, appropriate sanitation technologies, decision making for sanitation and stakeholder involvement in sanitation, which are crucial socio-economic aspects that influence sanitation and, consequently, overall socio-economic development. It is on these less investigated socio-economic dynamics that this study focused.

1.3 Study goal and objectives

The overall research question guiding this study therefore was "what and how do socio-economic dynamics interact to influence access to and management of sanitation in Kisumu's informal settlements?" This socio-economic interaction was assessed through the following four objectives and research questions:

1. To describe living conditions in the informal settlements of Kisumu.
    - What are the household, housing unit, compound and neighbourhood conditions in the settlements, and what opportunities exist for improving overall living conditions?

2. To estimate the cost of/payment for sanitation as reflected through house rental prices in Kisumu's informal settlements.
    - What is the cost of sanitation as determined by house rental prices, and what factors influence payment for sanitation in the settlements?
3. To investigate the socio-economic determinants of shared sanitation quality in the informal settlements.
    - How does the quality of shared sanitation facilities compare in the settlements, and what factors influence this quality?
4. To investigate decision making for sanitation in Kisumu's informal settlements
    - What types of sanitation decisions are made by households in the settlements, how are these decisions made, who makes these decisions, and what factors influence the making of these decisions?
    - Who are the sanitation stakeholders in the settlements, and how can they be involved in decision making?

1.4 Theoretical underpinnings

The overarching theme of this dissertation is development. Development encompasses various aspects, and this dissertation compares conventional (economic) and alternative approaches for development. The dissertation focuses on one of the consequences of conventional development approaches in the urban areas, i.e. the growth of informal settlements, as well as the conventional approaches that have been used to improve living conditions in these settlements. The dissertation also draws from alternative development approaches, and in particular, on infrastructural/service provision as an approach for improvement of living conditions in informal settlements. The main infrastructural service highlighted is sanitation.

The focus on sanitation is particularly due to the high number of people without sanitation, the unmet MDG target, the benefits associated with sanitation improvement, and the lack of data from informal settlements. A better understanding of sanitation in informal settlements is not only found in numbers indicating access, but also in deeper lying socio-economic dynamics within the settlements.

In Kenya and in most African countries, there is a lack of sanitation in informal settlements. A concern for development efforts would be the cost of sanitation, as it would give an indication of economic implications as well as options for financing of sanitation. Literature on economics, particularly on neoclassical approaches and methods for estimating the cost of goods and services, is referred to. The dissertation

particularly draws from the Hedonic Pricing Method (HPM) to aid in estimating the cost of sanitation in informal settlements, and the possible opportunities for financing.

Nevertheless, limitations of neoclassical economic approaches point to the need to not only focus on sanitation statistics (for example percentage of households with access to sanitation), but also on socio-economic dynamics at the household level that affect sanitation provision and management. For instance, how shared sanitation facilities, which are prevalent in informal settlements, should be kept clean for sustained use. Consequently, reference is made to the New Institutional Economics (NIE) literature, and in particular the Common Pool Resource (CPR) management principles as a lens to understand conditions that lead to successful sharing of sanitation in informal settlements.

Finally, sanitation, being a complex phenomenon, does not just involve a few individuals, and decisions are not always made in the manner suggested by economic models. Thus, to tie the loop back to development approaches, the dissertation explores alternative approaches and opportunities for sanitation research. In particular, the dissertation borrows principles of action/transdisciplinary research and stakeholder involvement for co-production. Such approaches are critical in answering questions of how alternative approaches can be utilised for decision making to ensure the improvement of sanitation and holistic development in informal settlements.

1.5 Significance and contribution of the research

This research contributes to the global development agenda on sanitation. The study is critical in the Kenyan context, where socio-economic development is included in the country's development agenda. Overall, this research contributes to data on Kisumu's informal settlements; and in particular, it is of interest to a number of stakeholders as it resonates with various disciplines including public health, engineering, social science, economics, and urban planning and management. The research sheds light on the cost of sanitation in informal settlements, information that is useful for planners and economists. For those in public health, this study reveals the hygienic conditions of shared sanitation facilities at the household level, therefore pointing to the need to focus on behaviour change at the household level. The need to focus on behaviour change calls for an understanding of social relations at the household level, a focus that would be of interest to social scientists and anthropologists. Moreover, this research shows that it is important to involve each

of these disciplines and stakeholders in decision making for sanitation in informal settlements, since each of them has a role to play in sanitation. This study has also combined various research methodologies and researchers could also make use of some of the research approaches that were employed in this study.

1.6 Overview of the dissertation

This dissertation is mainly about socio-economic dynamics within informal settlements that have an effect on sanitation provision/access and management. The dissertation is divided into eight chapters, which can broadly be divided into the literature review section, a section on methods, a section on results which are presented in the form of journal article papers, and a final section that concludes the dissertation.

Chapter 2 mainly covers the literature review. It begins by discussing the conventional theories of development, and one of the effects of these approaches-the growth of informal settlements. The chapter discusses the conventional approaches that were used to improve living conditions, their critique, and alternative approaches for improving conditions in these settlements. These alternative approaches include the need to focus on service delivery/infrastructure. The chapter then narrows down to sanitation in informal settlements as an important infrastructural service that requires improvement and which can be an avenue for development in informal settlements. With the focus on sanitation, the chapter reviews sanitation concerns in informal settlements and approaches that have been taken in various countries to improve the sanitation conditions. With this review, the chapter identifies some gaps in sanitation research. One of these gaps is the financing/cost of sanitation, and thus a review of economic methods of valuation and how they have been, and can be applied to estimate the cost of sanitation. Another gap is the software aspects such as behaviour, and thus a focus on heterodox economics and their application in sanitation. Gaps in sanitation decision making as well as issues of sanitation technology and land tenure influences are also highlighted. Finally, the chapter reviews opportunities for sanitation research including the use and examples of alternative research approaches and stakeholder involvement.

Chapter 3 pins the development issues discussed in Chapter 2 within the study area. It describes developmental issues of urbanisation, informality and sanitation in Kenya and in Kisumu city. The chapter further describes the overall research design, as well as the research procedures that were taken to answer the objectives.

The chapter concludes by highlighting the challenges encountered and the valuable lessons learnt during fieldwork.

The third section of this dissertation is a presentation of results, written in journal article format and answering the four main objectives. **Chapter 4** discusses living conditions in Kisumu's informal settlements. The chapter presents conditions in the settlements that directly or indirectly influence sanitation which also are highlighted in the subsequent chapters. An interesting highlight of these results is the pointer to basic services such as sanitation as an avenue for the improvement of living conditions in the settlements.

In line with the second objective, **Chapter 5** uses the hedonic pricing method to estimate the cost of sanitation as reflected through rental prices. The method leads to an estimate of the cost of sanitation as reflected in house rental prices in the settlements. However, the results show that overreliance on models alone is not sufficient to understand the socio-economic dynamics that influence sanitation in informal settlements.

In answering the third objective, **Chapter 6** assesses the determinants of the quality of shared sanitation. The chapter uses an approach from the heterodox school of thought, specifically the Common Pool Resource (CPR) Management principles, to further assess determinants of the quality of shared sanitation. The highlight of this chapter is that development efforts ought not to focus only on sanitation provision, but also on strategies to ensure that shared sanitation facilities are in a hygienic and useable condition.

Chapter 7, tallying with the last objective, investigates decision making for sanitation in the settlements. The highlight of this chapter is that, unlike economic models that imply individualistic decision making, decision making for sanitation in informal settlements is complex, often involving more than one person. The chapter investigates decision making on three levels: the household, the community and the city, and uses principles from transdisciplinary research approach to involve stakeholders in the co-production of knowledge.

Chapter 8, the final chapter in the dissertation, pieces together the main highlights of the dissertation, and makes recommendations relevant for research and policy. It also highlights the contribution made by this research to theory and practice.

A flow diagram of the chapters in the dissertation is presented in Figure 1.2.

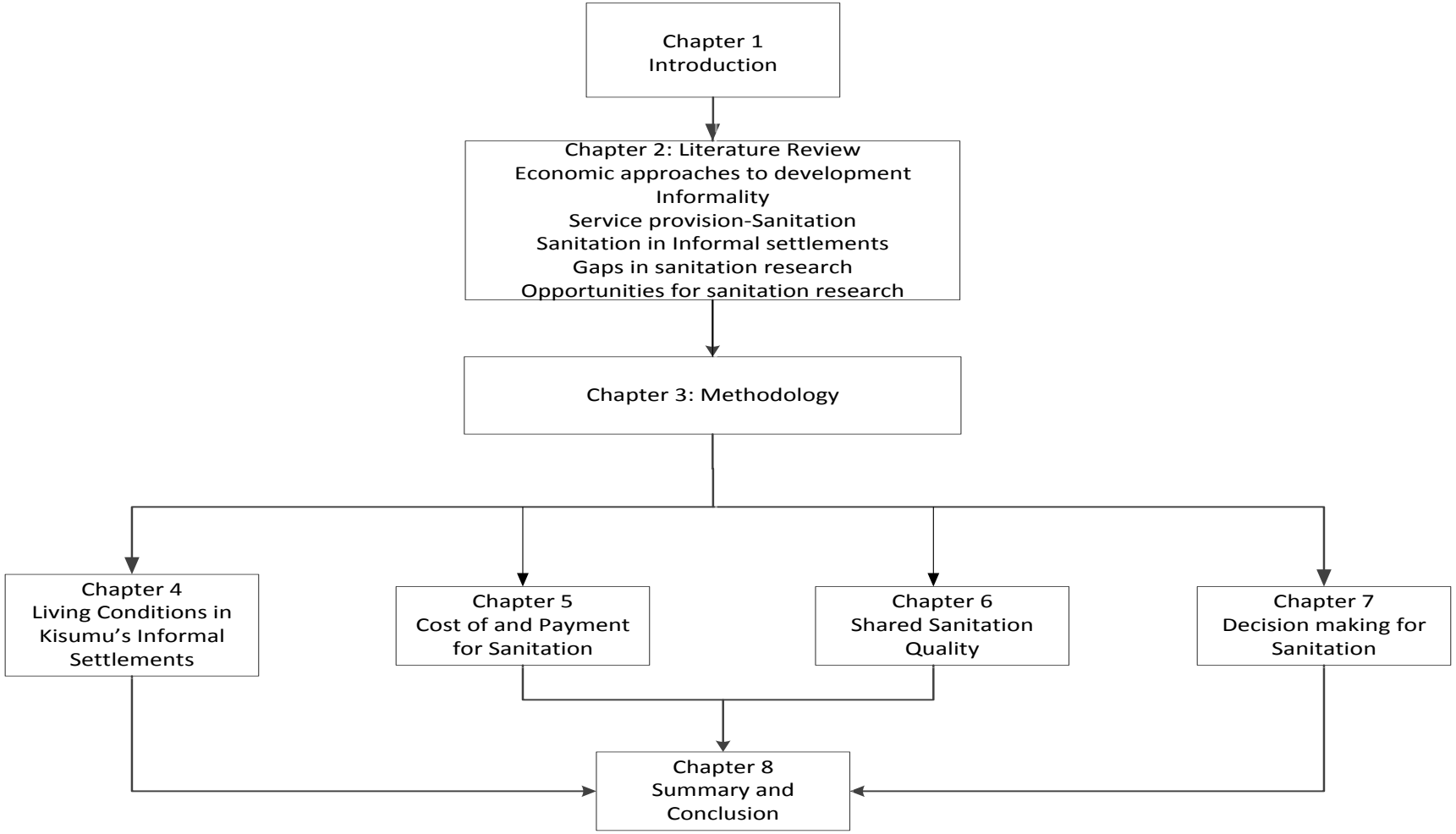

Figure 1.2 Flow diagram of chapters in the dissertation.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter provides a review of literature that covers socio-economic aspects of sanitation in informal settlements. The chapter begins with an introduction to conventional theories of development and the resultant effects, such as urbanisation and the growth of informal settlements. The chapter then analyses traditional approaches that were used to address informal settlements and their critique. Alternative approaches for development in informal settlements are then reviewed, with a focus on infrastructural development as an avenue for improvement of informal settlements. Focus then narrows down to sanitation as an infrastructural service, sanitation challenges in informal settlements and approaches that have been used for the improvement of sanitation conditions in informal settlements. The chapter then singles out gaps in sanitation research, including financing options with a focus on the economic approaches for costing sanitation; software aspects and the applicability of alternative heterodox approaches in sanitation; decision making, and the influence of land tenure. Drawing from these gaps, the chapter reviews opportunities for sanitation research, including the use of participatory research approaches such as action and transdisciplinary research, and the involvement of stakeholders for co-production.

2.2 Economic theories of development

The term development has been used in various disciplines, and has attracted various definitions. Development generally refers to making a better life for everyone, or changing the world for the better (Peet & Hartwick, 2015:1,3). It therefore implies economic, social and cultural progress (Peet & Hartwick, 2015:3). Development aims at increasing the availability of basic goods, raising the standard of living, and expanding the range of economic and social choices that are available to individuals (Todaro & Smith, 2015:24).

Over the years, there have been various approaches of how development can be attained. Conventional theories of development were based on classical and neoclassical economics, in which development was measured as economic growth (Peet & Hartwick, 2015:6; Todaro & Smith, 2015:16; McMichael, 2016:21). These economic theories of development were based on capitalism where wealth is accumulated by a few individuals (Peet & Hartwick, 2015:17,23) and growth is explained using mathematical models (Peet & Hartwick, 2015:17). The theories

explain that individuals are perfectly rational, foresighted and have perfect information (Peet & Hartwick, 2015:52).

One consequence of these conventional approaches was extreme inequalities in income distribution, as the rich took most of the income that the economy produced (Peet & Hartwick, 2015:9). This inequality resulted to a 'development paradox' (McMichael, 2016:14) as there was an increase in unemployment and poverty accompanied economic growth (Peet & Hartwick, 2015:9; Todaro & Smith, 2015:17). According to conventional thinking however, this poverty is rectifiable through faster growth (Peet & Hartwick, 2015:23-24).

In Africa, these theories became widespread during the colonial period, and (developing) countries yielded to modernity by embracing industrialisation as a way of development as exemplified by the western (developed) countries; with one outcome being increasing urbanisation (McMichael, 2016:7).

2.2.1 Effects of economic theories of development

2.2.1.1 Urbanisation and growth of informal settlements

Urbanisation is a term that is used to refer to the movement of people from rural areas to towns, or to the proportion of a country's population that lives in urban areas (Parnell & Walawege, 2014). Urbanisation has been on an upward trend and more than half of the world's population now lives in urban areas (UN-Habitat, 2013:25). In developing countries particularly, the rate of urban population growth is higher than that in developed countries. As of 2010, for example, the urban population growth rate in developing countries was 2.4% per annum, which is 3.5 times higher than the annual average population growth rate in developed countries (UN-Habitat, 2013:29). Notably, out of every ten urban residents of the world, more than seven are in developing countries (UN-Habitat, 2013:25). In Africa particularly, it is projected that the number of urban dwellers will increase at a faster rate than the overall population growth in the region by the year 2050 (UN-Habitat, 2014:24) and that, by 2020, African cities will have expanded by 150 million (Parnell & Walawege, 2014). Eastern Africa is the least urbanised region in the world, but the fastest urbanising region in Africa, with a high rate of growth in its urban population (UN-Habitat, 2010:16, 2014:11).

This increase in the urban population has not been at a par with economic development, which has led to (among others) the urbanisation of poverty, inequality,

and the growth of unplanned informal settlements (UN-Habitat, 2014:31; Zhang, 2016).

Of particular interest to this dissertation is the occurrence of informal settlements. Statistics from the United Nations (UN) show that by 2012, there were approximately 863 million people living in informal settlements worldwide (United Nations, 2014:46). These settlements, otherwise referred to as 'slums', are often viewed as being illegal (Lawanson, 2015; Lino e Silva, 2015; Olthuis, Benni, Eichwede & Zevenbergen, 2015). They are characterised by poor living conditions, overcrowding, a lack of basic services and infrastructure (such as water and sanitation), tenure insecurity and substandard housing (UN-Habitat, 2003a, 2014:31; Davis, 2006; Mutisya & Yarime, 2011; Cranby, 2012; Nuissl & Heinrichs, 2013; Harris, 2014; Huchzermeyer, 2014). Residents of these settlements are faced with vulnerabilities such as inadequate and unstable incomes, payment of high prices for necessities, inadequate protection of rights through the operation of the law, voiceless-ness and powerless-ness within political systems, inadequate provision of infrastructure, lack of collateral for accessing credit, few or no savings, and health burdens from undernutrition and the use of poor quality food, fuel and water (Satterthwaite & Mitlin, 2014:240-241). These settlements are sometimes also situated in areas where residents are vulnerable to the effects of climate change and environmental disasters such as floods (Adegun, 2015; Olthuis *et al.*, 2015; Scovronick, Lloyd & Kovats, 2015; Taylor, 2015).

Home (2014) and Huchzermeyer (2014) trace the growth of informal settlements in Africa to the colonial era, describing that they began as temporary sites provided by European employers for African workers, but that, over time, they expanded due to rural-urban migration. These migrants, who form a large portion of the urban poor, settled close to areas that offer economic/employment opportunities (Cranby, 2012; Marx, Stoker & Suri, 2013; Tacoli, Mcgranahan & Satterthwaite, 2015), so that they can send money back to their families in the rural areas. Fox (2014a) adds that, in Africa, informal settlements developed because national governments were not prepared to handle the effects of positive innovations (such as surplus food supplies, increased fertility, and decline in mortality) that had been begun by the colonialists, which then resulted in unprecedented population growth. Over the years, national governments have either neglected these settlements (Fox, 2014b), or they have been unable to provide infrastructural services to the growing population (UN-Habitat, 2003a; Ooi & Phua, 2007; Guevara, 2014). Njoh (2015), on the other hand, is of a

different opinion and, using data from various African countries, he argues that colonialism is associated with less occurrence of informal settlements.

Over the years, urban planning approaches, many of which were adopted from the colonial era, also led to the co-production of informal settlements as planners prioritised generous land allocation to land reserves and public spaces, without foreseeing scarcity of land due to population growth (Huchzermeyer, 2014; Watson, 2014). The result was that the rich settled in the best areas and the poor were spatially excluded from the planned areas, being forced to settle in the open, unused and unregulated parts of the city (Huchzermeyer, 2014; Watson, 2014).

Informal settlements have often been associated with derogatory images of elements such as crime, violence, disorder, violation of rules, insecurity and disease (Davis, 2006; Gilbert, 2007; Unger & Riley, 2007; Avni & Yiftachel, 2014; UN-Habitat, 2014:31; Watson, 2014; Lino e Silva, 2015; Woldeamanuel & Palma, 2015). On a positive side, they provide shelter to a majority of the urban poor, including minorities and immigrants (Gulyani & Talukdar, 2008; Harris, 2014; Roy, Lees, Palavalli, Pfeffer & Sloot, 2014; UN-Habitat, 2014:43; Turok & Borel-Saladin, 2015), and it is estimated that they house a third or more of a city's population (Satterthwaite & Mitlin, 2014:4). In Africa, for instance, approximately 62-70% of the urban population lives in informal settlements (UN-Habitat, 2013:151; Turok, 2014; Zhang, 2016).

Informality basically exists in many countries in the world. Authors have made mention of informality in Sri Lanka and Israel (Avni & Yiftachel, 2014), Brazil (Lino e Silva, 2015), China (Lees, 2014; Iossifova, 2015), as well as Greece, Italy and Portugal (Lees, 2014; Ascensão, 2015). Nevertheless, informality is a defining characteristic of cities in most developing countries, or countries in the 'global south' (Harris, 2014).

2.2.2 Conventional development responses to informal settlements

In response to the burgeoning informal settlements, national governments have ignored/neglected informal settlements, or inhibited their growth by limiting access to services or by restrictive land policies (Allen, 2014; Avni & Yiftachel, 2014). Conventional responses have mainly been clearing/eviction of informal settlements and at times through offering security of tenure.

Clearance and evictions

Many times, efforts to get rid of informal settlements have been through the clearance of housing and the eviction of residents from informal settlements. Clearance, evictions and/or resettlement have been reported in Brazil (Guevara, 2014), Spain (Cavalheiro & Abiko, 2015; Gago-Cortés & Novo-Corti, 2015), China (Lees, 2014) Sri Lanka and Israel (Avni & Yiftachel, 2014), Indonesia (Taylor, 2015), Portugal (Ascensão, 2015), and Zimbabwe (Gervais-Lambony, 2014; Muchadenyika, 2015). Such evictions are usually informed by the policymakers' need to plan cities, and at other times they are due to the vulnerability of informal settlements to environmental disasters (Navarro, 2014).

Security of tenure

Security of tenure as an avenue for improvement borrows from De Soto (2000:6-7), who argues that the poor can use resources such as formal land titles to access loans that can be used for wealth creation and poverty alleviation, thus leading to economic growth. In the developed world, security of tenure can be acquired through formal land titling (De Soto, 2000; Handzic, 2010), which becomes an assurance of property ownership. In developing countries, however, security of tenure can take several forms (Patel, Joshi, Ballaney & Nohn, 2011; Minnery, Argo, Winarso, Hau, Veneracion, *et al.*, 2013). Where formal land titling is not possible, it is suggested that tenure can be secured through temporary occupation licences, certificates of rights, and temporary land rentals (Durand-Lasserve, 2006; Durand-Lasserve & Selod, 2009), all of which provide safety to reside in a given environment and to access relevant authorities during a claim/dispute (Patel, 2013). More recently, strategies such as paying house rent fees, allegiance to political affiliations, and belonging to the indigenous inhabitants of an area have been mentioned to offer security, especially among tenants in informal settlements (Pugalis, Giddings & Anyigor, 2014; Paller, 2015).

Those in favour of security of tenure argue that it encourages governance, community participation and economic improvement, since residents can access credit from microfinance institutions which they can use for the improvement of their living conditions (Minnery *et al.*, 2013; Krishna, Sriram & Prakash, 2014; Mittal & Swamy, 2014). Since residents of informal settlements have not been keen to invest in improvements due to insecure land tenure (Durand-Lasserve, 2006; Patel *et al.*, 2011; Marx *et al.*, 2013), tenure security, it is argued, provides residents with a

perceived security that allows them to invest in and acquire other services (Jain, Knieling & Taubenböck, 2015; Muchadenyika, 2015).

2.2.3 Critique of conventional approaches to development

Conventional development approaches have received criticism as they are centred on economics, emphasising economic growth over development. Critics argue that development does not work because it is disciplined by conventional economics which leads to concentration of wealth in the hands of a few individuals (Peet & Hartwick, 2015:3,23-24). These approaches are faulted for relying on simplistic assumptions about human behaviour that are assumed to be always true, and thus only representing reality in theoretical terms (Peet & Hartwick, 2015:52,116).

The conventional responses of clearance and land titling of informal settlements have also received critique. Clearance and eviction have been faulted for not taking into account systems that improve the welfare of the affected people, who often times are not involved in decision making (Gago-Cortés & Novo-Corti, 2015; Woldeamanuel & Palma, 2015), but are pushed to the periphery or forced out of their settlements in order to put up modern structures, as noted in Argentina (Sequera & Mateos, 2015), India (Bardhan, Sarkar, Jana & Velaga, 2015; Jain *et al.*, 2015) and Nigeria (Agunbiade, Olajide & Bishi, 2015; Daniel, Wapwera, Akande, Musa & Aliyu, 2015; Lawanson, 2015; Woldeamanuel & Palma, 2015).

Resettlement results in destroying the existing social and economic networks as well as higher costs for residents, who often have to pay more for housing. Therefore, due to these negative effects, residents are often resistant to relocate (Nuissl & Heinrichs, 2013; Guevara, 2014; Taylor, 2015). Woldeamanuel and Palma (2015) sum up that relocation only worsens the problem rather than solving it, since the displaced people move to other areas where they still erect informal housing.

Critics also argue that formal land titling is not an important or necessary requirement for the improvement of living conditions. Formalisation increases property values, but there is little evidence that it has an impact on access to credit (Durand-Lasserve & Selod, 2009; Payne & Durand-Lasserve, 2012; Guevara, 2014). In addition, using land titles as collateral for loans may have an impact on the owner at the local level in case of any instability at the global level.

Research from Brazil, India and Nigeria confirms that land ownership is not a prerequisite for households to improve their living conditions, and that residents are usually not interested in using land titles as collateral for loans (Handzic, 2010;

Agunbiade *et al.*, 2015; Parikh, Fu, Parikh, McRobie & George, 2015). In African countries, formal land titling is reported to be faced with various challenges: it may not be desired by residents; it is usually marred by high costs, delays and corruption from officials; it may lead to gentrification; and it may lead to forced evictions and increased house rents, all of which worsen the conditions of the (poor) residents living in informal settlements (Durand-Lasserve, 2006; Gilbert, 2014; Marais, Ntema, Cloete & Venter, 2014; Rakodi, 2014; Agunbiade *et al.*, 2015; Obeng-Odoom, 2015).

In summation, Obeng-Odom (2013) argues that, policies on urban development and poverty reduction borrow from De Soto's theory, which leans towards an economic neoliberal approach of addressing poverty. He goes on to say that De Soto's analysis of economic development among the poor is insufficient, as it ignores factors such as labour and social relations between humans, which are also critically important in economic development (Obeng-Odoom, 2013).

2.3 Alternative development approaches

From the mid-2000s, there have been proposals for alternative approaches to development. Davids (2014) recommends development that is 'people-centred', integrating public participation, social learning, empowering and sustainability, thereby offering a human orientation to development. Peet and Hartwick (2015:3) propose that development should start at the bottom rather than the top.

Authors suggest that development needs to be inclusive by involving all relevant stakeholders. Approaches for development therefore need to find new modes of engagement with different stakeholders including state agencies (Allen, Lampis & Swilling, 2015; Mubaya, Mutopo & Ndebele-Murisa, 2015).

Informal settlements are generally noted to contribute significantly to urban life and global economies through cultural diversity and innovation, tourism, film and art (Jones & Sanyal, 2015; Lee, 2016); and informality suggests that there can be order in the seemingly chaotic informal settlements (Guevara, 2014). Informality should thus be viewed as a response mechanism of poor residents to multiple vulnerabilities (Lawanson, 2015). These residents adapt by transforming their means of survival into means of sustenance (Lawanson, 2015; Amoako & Frimpong Boamah, 2016); for example, at the basic level, the urban poor residents have labour, which is a form of human capital (Rakodi, 2014).

Approaches for improvement should therefore deal with most of the challenges in informal settlements simultaneously (Satterthwaite & Mitlin, 2014:240-241), use the

available opportunities for improvement, and consider differences and dynamics within each informal settlement (Beyer, Chaudhuri & Kagima, 2016). Governments should not get rid of, or neglect informal settlements (Avni & Yiftachel, 2014; Turok, 2014), but rather recognise them as valid and productive forms of urbanism (Andersen, 2014) and focus on improving the dynamics of urbanisation, increasing public investment and upgrading incrementally (Turok, 2014; Amoako & Frimpong Boamah, 2016). Informality should be considered as a pointer to the relationships between the authorised and unauthorised and strategies should resolve the tension between urban policies and urban realities (Lawanson, 2015); but they should be a joint effort between the relevant stakeholders (Huchzermeyer, 2014). For example, sustainability in housing requires the involvement of residents in housing projects though skill improvement and provision of building materials; as well as the involvement of community based organisations, which will ensure social sustainability (Bredenoord, 2016).

Other authors recommend that development efforts in informal settlements should adopt approaches that involve service delivery and participatory decision making (Guevara, 2014; Pimentel Walker, 2016).

2.3.1 Upgrading of housing in informal settlements

With these suggestions and proposals, a number of approaches have been proposed and adopted to improve living conditions in informal settlements. An alternative approach to eviction and resettlement has been the provision of housing. Drawing from success experienced in Singapore and China, Ooi and Phua (2007) argue that, in order to curb the expansion of informal settlements in cities with urban growth, governments should provide basic housing for low-income earners who are not likely to afford high-cost housing. In situ improvement/upgrading of housing in informal settlements is preferred because it is cheaper, and residents still maintain their existing social and economic networks (Patel *et al.*, 2011; Andersen, 2014; Gilbert, 2014). This kind of upgrading has been implemented in various countries including South Africa (Shortt & Hammett, 2013; Drivdal, 2015; Khan & Wallis, 2015), Indonesia (Joesron, Syahbana & Manaf, 2014), Pakistan (Malik & Wahid, 2014), Nigeria (Pugalis *et al.*, 2014), Mauritius (Gooding, 2016), and India (Chatterjee, 2015). Other approaches to improving housing include the Emergency Housing Programme (EHP) and the Reconstruction and Development Programme (RDP) in South Africa, which provide housing in emergencies and to low-income households respectively (Narsai, Taylor, Jinabhai & Stevens, 2013; Cirolia, 2014).

Success stories of successful upgrading of housing in informal settlements have been noted in Indonesia (Taylor, 2015), Mauritius (Gooding, 2016) and Brazil (Pimentel Walker, 2016) where citizens have been involved in development efforts as decision makers through continuous consultations with government bodies.

In spite of these efforts, there still is a high demand for housing in informal settlements due to population growth. This growing population consists largely of tenants, who may not be interested in owning housing or may not even be able to afford to purchase housing or land (Gilbert, 2014; Ahmad, 2015a). Consequently, some areas of informal settlements are experiencing a shift to multi-storey buildings in order to accommodate more people (Jain *et al.*, 2015; McGaffin, Cirolia & Massyn, 2015). There also has been an increase in petty or small-scale landlordism, which occurs through sharing rooms in a single house, as reported in Zambia (Taylor, Banda-Thole & Mwanangombe, 2015), Ghana (Tutu, 2014; Addo, 2015; Amoako & Frimpong Boamah, 2016), Zimbabwe (Manjengwa, Matema & Tirivanhu, 2016), and in South Africa in the case of backyard shacks (Lemanski, 2009; Govender, Barnes & Pieper, 2011; Turok & Borel-Saladin, 2014, 2015). These petty landlords, who are usually from similar socio-economic backgrounds as their tenants, make use of opportunities that allow them to make extra income from their tenants, such as rent increases or the sale of basic service such as water (Huchzermeyer, 2008; Opoko, 2014; Paller, 2015; Turok & Borel-Saladin, 2015). In countries such as Ghana, these landlords have also been reported to make use of rent from their tenants to make expansion to their housing units in order to accommodate more tenants (Amoako & Frimpong Boamah, 2016).

In view of the preceding discussion, it is apparent that there is an increase in the number of people living in cities who need to be accommodated in the urban areas. Differences in income levels imply that people who cannot be housed in the formal, planned areas of the city end up living in informal settlements. These settlements therefore are a reality that is unlikely to disappear soon (Semiyaga, Okure, Niwagaba, Katukiza & Kansiime, 2015) and, assuming that the settlements will disappear under state-managed or market-driven modernity is an unrealisable expectation (Allen *et al.*, 2015). The settlements should therefore be recognised and viewed as settlements of 'hope' rather than of 'despair' (Nuissl & Heinrichs, 2013), whose topological politics, according to McFarlane (2015), will soon become an urgent field for research, policy and practice.

The occurrence of these informal settlements in developed and developing countries, and the different names used to describe these settlements, are pointers to the varied living conditions across countries. Perhaps what varies across the countries is the degree and severity of informality. This difference therefore begs a thorough examination of living conditions in order to devise avenues for their improvement. Further analysis of the interrelatedness of living conditions including the role of poverty, as described by a number of studies (Gulyani & Talukdar, 2008; Gulyani & Bassett, 2010; Gulyani, Talukdar & Jack, 2010; Gulyani, Bassett & Talukdar, 2012, 2014; Sajjad, 2014) is also worthwhile. Iterating the same sentiments from the perspective of poverty, Satterthwaite and Mitlin (2014:6) recommend that it is important to understand the different factors that create or exacerbate inequality in order to identify avenues through which the inequality can be reduced. In the same manner, it is important to understand living conditions in informal settlements, how they work together to create inequality, and how their working together can be an avenue for improvement.

2.4 Infrastructural development as an approach for development

At a macro-level, it is posited that investment in infrastructure such as roads, telecommunication, water, sanitation, and electricity has an impact on growth/development, the elimination of poverty, and improvement of living conditions. Investment in infrastructure has social benefits such as increased market access, as well as better education and better health (Estache & Wodon, 2014:16). Investment in water and sanitation particularly correlates with an improvement in the health and education sectors (Estache & Wodon, 2014:13-14,21). For sanitation in particular, the WHO estimates that for every one United States Dollar (USD) invested, there is a global economic return of 5USD, compared to a return of 2USD for every USD invested in drinking water supply (WHO, 2012).

2.4.1 Basic service/infrastructure provision in informal settlements

In informal settlements, upgrading of housing is often accompanied by the provision and/or improvement of infrastructural services (Guevara, 2014; Olthuis *et al.*, 2015; Woldeamanuel & Palma, 2015), and authors recommend that development efforts in informal settlements should focus on service delivery and approaches that require participatory decision making (Guevara, 2014; Pimentel Walker, 2016).

Some research in informal settlements has therefore focused on avenues for the provision or improvement of services, such as that by Crow and Odaba (2010) and Crow *et al.* (2013) on water in informal settlements, Panek and Sobotova (2015) on

community mapping in informal settlements, Kimani-Murage *et al.* (2014) on food insecurity, and various others who have focused on general living conditions in informal settlements (Ansell & Van Blerk, 2005; Gulyani & Talukdar, 2008; Sajjad, 2014), as well as on health conditions/ health care in informal settlements (Vlahov, Freudenberg, Proietti, Ompad, Quinn, *et al.*, 2007; Kulkarni, 2013; Subbaraman, Nolan, Shitole, Sawant, Shitole, *et al.*, 2014; Tackie-Ofosu, Mahama, Kumador, Budu, Sackey, *et al.*, 2014; Adams, Islam & Ahmed, 2015; Buigut, Ettarh & Amendah, 2015; Kumar, 2015; Nwokoro, Lawanson, Ebuehi, Fadare, Agwu, *et al.*, 2015; Parikh *et al.*, 2015; Shibata, Wilson, Watson, Nikitin, Ansariadi, *et al.*, 2015; Owusu-Ansah, Tagbor & Togbe, 2016). The provision of basic services benefits the residents in various ways; for example, from a study in India, Parikh, Chaturvedi and George (2012) highlight that the provision of basic services such as energy aligns with the residents' basic aspirations, provides positive outcomes and empowers them to shift to higher order aspirations and social needs.

However, the provision of basic services in informal settlements faces various challenges such as political interference (e.g. when politicians promise to deliver services to residents in order to gain votes) (Guevara, 2014; Michelutti & Smith, 2014; UN-Habitat, 2014; Paller, 2015), lack of coordination among stakeholders, interference from influential individuals so that the poor do not receive the intended improvements (Michelutti & Smith, 2014), as was the case in India (Jain *et al.*, 2015; Khan & Wallis, 2015) and Kenya (Huchzermeyer, 2008); insufficient funding; and a lack of community involvement (Woldeamanuel & Palma, 2015).

In spite of these challenges, the provision of services and infrastructure leads to a general improvement in the living conditions and well-being of residents (Parikh *et al.*, 2015). One of such infrastructural service is sanitation.

2.4.2 The case for sanitation infrastructure/service in informal settlements

Sanitation is one of the main services lacking in most informal settlements, evidently noted by the increasing number of people in urban areas without sanitation, as highlighted in Chapter 1.

From a public health perspective, the lack of sanitation leads to the spread of sanitation related diseases that can spread from the household level to the city level (IWA, 2014). Reviews from several countries indicate that in 2012 for example, 280,000 diarrhoea deaths were caused by inadequate sanitation (Prüss-Ustün, Bartram, Clasen, Colford, Cumming, *et al.*, 2014). Lack of sanitation is also

associated with the occurrence of health outcomes such as soil-transmitted helminth infections (Ziegelbauer, Speich, Mäusezahl, Bos, Keiser, *et al.*, 2012; Strunz, Addiss, Stocks, Ogden, Utzinger, *et al.*, 2014) and trachoma (Stocks, Ogden, Haddad, Addiss, McGuire, *et al.*, 2014).

These public health risks of unsafe excreta disposal are greater in dense urban populations (such as informal settlements) than in low-density rural populations, because in the latter, open defecation occurs away from areas of human habitation (Brown, Cumming, Bartram, Cairncross, Ensink, *et al.*, 2015). Reviews show that there are higher cases of infant and under five mortality, morbidity from diarrhoeal diseases and respiratory illness, and malnutrition among children in informal settlements compared to those not living in informal settlements (Unger, 2013). For sanitation in particular, the health burden associated with lack of or poor sanitation falls on children mainly due to greater exposure to infection or higher susceptibility, resulting in higher mortality (Rheingans *et al.*, 2012).

The provision of sanitation thus leads to benefits such as reducing the risk of morbidity and mortality from preventable sanitation-related diseases (Buttenheim, 2009; Bartram & Cairncross, 2010; Mara *et al.*, 2010; Prüss-Ustün *et al.*, 2014; Wolf *et al.*, 2014; Brown *et al.*, 2015), soil transmitted helminth infections (Ziegelbauer *et al.*, 2012) and chronic diseases (Kumar, 2015). Improved sanitation in particular reduces diarrhoeal morbidity by approximately 28% in low and middle income settings (Wolf *et al.*, 2014). The use of sanitation facilities is also associated with a reduction in the risk of trachoma (Montgomery, Desai & Elimelech, 2010). Access to sanitation also results in time savings of between 70-90%, health benefits such as saved lives, as well as health care savings (WHO, 2012). For girls and women, provision of sanitation implies that more time can be spent on education, which can then result in improved quality of life. Overall, provision of sanitation leads to general economic improvement (Hutton *et al.*, 2007; Lüthi *et al.*, 2011; WHO, 2012).

In spite of these benefits of access to sanitation, informal settlements have a number of socio-economic concerns related to sanitation that influence provision of and access to sanitation.

2.4.2.1 Sanitation concerns in informal settlements

Lack of or inadequate sanitation facilities

Overcrowding, inadequate or total lack of financing, and the failure of governments to provide services leads to the inadequacy and/or total lack of private sanitation

facilities in most informal settlements in developing countries (Katukiza, Ronteltap, Niwagaba, Foppen, Kansiime, *et al.*, 2012; Obeng, Keraita, Oduro-Kwarteng, Bregnhøj, Abaidoo, *et al.*, 2015; Russel, Tilmans, Kramer, Sklar, Tillias, *et al.*, 2015). This insufficiency and/or lack results in the use of alternatives such as open defecation (Gulyani *et al.*, 2010; Cronin & Guthrie, 2011; Chinyama, Chipato & Mangore, 2012; Katukiza *et al.*, 2012; Tumwebaze, Orach, Niwagaba, Luthi & Mosler, 2013; Nimoh & Poku, 2014; Wankhade, 2015), which exposes the population to sanitation-related diseases. The lack of sanitation also has social implications. Iossifova (2015), for instance, found that residents living in informal settlements in China (mostly the elderly) who are not served with sanitation facilities make do with alternatives such as buckets in their homes. As a result, their family members who live in areas served with sanitation facilities are reluctant to visit them because of this lack of sanitation facilities.

Financing for sanitation

From an investment perspective, it is difficult and costly to install sanitation infrastructure such as sewer systems; and sanitation infrastructure does not attract an immediate and greater return on investment compared to infrastructure such as telecommunication, roads and electricity (Estache & Wodon, 2014:13-14). Consequently, the sanitation sector has not been prioritised in most development projects (Isunju *et al.*, 2011). In addition to these challenges, governments are faced with limited public finances, hence their seemingly absent roles in providing sanitation in informal settlements (Galli, Nothomb & Baetings, 2014).

Poor households in informal settlements thus often provide sanitation infrastructure for themselves. Unfortunately, they may not have funds for private sanitation as it may be too expensive for them (Tsinda, Abbott, Pedley, Charles, Adogo, *et al.*, 2013; Russel *et al.*, 2015; Satterthwaite, Mitlin & Bartlett, 2015; Wankhade, 2015), and alternatives such as loans from banks may attract high interest rates (Nimoh & Poku, 2014).

Sanitation technology

Due to overcrowding there are limited sanitation technologies that are appropriate for informal settlements (Lüthi, McConville & Kvarnström, 2010; Galli *et al.*, 2014). Pit latrines are common in informal settlements (Tumwebaze *et al.*, 2013; Semiyaga *et al.*, 2015), as noted in East African countries such as Kenya, Uganda, Tanzania and Rwanda (Niwagaba, Ssemanda, Sande & Kamara, 2008; Kulabako, Nalubega,

Wozezi & Thunvik, 2010; Omambia, 2010; Szántó, Letema, Tukahirwa, Mgana, Oosterveer, *et al.*, 2012; Isunju, Etajak, Mwalwega, Kimwaga, Atekyereza, *et al.*, 2013; Pieter Van Dijk, Etajak, Mwalwega & Ssempebwa, 2014; Jenkins, Cumming & Cairncross, 2015; Nakagiri, Kulabako, Nyenje, Tumuhairwe, Niwagaba, *et al.*, 2015; Tsinda, Abbott & Chenoweth, 2015); and also in other countries such as Ghana (Adubofour, Obiri-Danso & Quansah, 2013; Obeng *et al.*, 2015), Zimbabwe (Chinyama *et al.*, 2012) Malawi (Chunga, Ensink, Jenkins & Brown, 2016) and Senegal (Gulyani *et al.*, 2010; Scott, Cotton & Sohail Khan, 2013).

The advantage of pit latrines is that they can be constructed easily using local materials, do not require a constant water supply (which may be unreliable in informal settlements), and they have low construction and operation costs (Katukiza *et al.*, 2012; Szántó *et al.*, 2012). Challenges with pit latrines are that they are smelly, they attract flies, and the pits can be breeding grounds for insects such as mosquitoes, all of which are a nuisance to users and can pose public health risks (Nakagiri, Niwagaba, Nyenje, Kulabako, Tumuhairwe, *et al.*, 2016). In addition, they are usually constructed by individuals who lack technical capacity, they are prone to collapse, may pollute water systems, and they require emptying, which is challenging because municipal trucks cannot easily access the congested settlements (Katukiza *et al.*, 2012; Tsinda *et al.*, 2013; Kwiringira, Atekyereza, Niwagaba & Günther, 2014a; Semiyaga *et al.*, 2015). To guard against collapsing and pollution of water bodies, pit latrines are at times constructed by being raised from the ground (Niwagaba *et al.*, 2008; Isunju *et al.*, 2013).

When these latrines fill up, households may prefer to dig another pit, but sometimes this may not be possible because of a lack of space and financial constraints (Jenkins *et al.*, 2015; Chunga *et al.*, 2016), hence other options, such as manual emptying, flooding out the pit contents, using vacuum tankers, using mini-vacuum tankers such as the vacutug and using a gulper, are usually employed (Jenkins, Cumming, Scott & Cairncross, 2014; Jenkins *et al.*, 2015; Semiyaga *et al.*, 2015; Tsinda *et al.*, 2015; Chunga *et al.*, 2016). Manual (bucket) emptying is cheaper and commonly used by households, although it presents health risks to the workers (Thye, Templeton & Ali, 2011; Katukiza *et al.*, 2012; Galli *et al.*, 2014; Satterthwaite *et al.*, 2015; Semiyaga *et al.*, 2015; Tsinda *et al.*, 2015).

Sharing sanitation facilities

Due to the aforementioned challenges, sanitation facilities in informal settlements are often shared. It is estimated that 638 million people share sanitation facilities worldwide, with most of this sharing occurring in sub-Saharan Africa. The total number of people sharing is greater in urban areas (398 million) compared to rural areas (240 million) (UNICEF & WHO, 2015). Shared sanitation facilities are considered 'unimproved' because of the difficulties in keeping them clean, with the JMP recommending further research on shared sanitation (UNICEF & WHO, 2013).

Sharing sanitation facilities in informal settlements happens at various levels, with household-level sharing being common in developing countries (Tumwebaze *et al.*, 2013), for example India (Heijnen, Routray, Torondel & Clasen, 2015), Kenya, Uganda (Nakagiri *et al.*, 2015; O'Keefe, Lüthi, Tumwebaze & Tobias, 2015), Senegal (Scott *et al.*, 2013) and Ghana (Appiah & Oduro-Kwarteng, 2011a). Aside from household-level sharing, sanitation facilities are also shared at a communal level (communal or community-based facilities), in which case they are managed and used by members of the community, who mostly have to pay per use (Wegelin-Schuringa & Kodo, 1997; Mazeau & Reed, 2010; Biran, Jenkins, Dabrase & Bhagwat, 2011; Mazeau, Reed, Sansom & Scott, 2014; Heijnen *et al.*, 2015; Obeng *et al.*, 2015; Satterthwaite *et al.*, 2015). They are also shared at a public level (public facilities), in which case the facilities are situated in or near informal settlements, often operating as a business, and which can be used by anyone also on a pay-per-use basis (Wegelin-Schuringa & Kodo, 1997; Mazeau & Reed, 2010; Mazeau, Benedict & Sansom, 2011; Mazeau *et al.*, 2014; Harris, 2015; Obeng *et al.*, 2015; Peprah, Baker, Moe, Robb, Wellington, *et al.*, 2015; Satterthwaite *et al.*, 2015).

Research indicates that sharing sanitation facilities presents difficulties in responsibilities related to cleaning and maintenance (Isunju *et al.*, 2011; Kwiringira *et al.*, 2014a), as studies in informal settlements have shown that shared sanitation facilities are usually not hygienically clean (Günther, Niwagaba, Lüthi, Horst, Mosler, *et al.*, 2012; Tumwebaze, 2013; Tumwebaze *et al.*, 2013), mainly due to the practices and behaviour of the users (Tumwebaze, 2013; Kwiringira, Atekyereza, Niwagaba & Günther, 2014b; Tumwebaze & Mosler, 2014a; Tumwebaze, Niwagaba, Günther & Mosler, 2014). Research further suggests that shared facilities may be kept clean with a few number of users, but with increasing number of users the shared facilities are not likely to be clean, leading to dissatisfaction among users (Günther *et al.*, 2012; Tumwebaze, 2013; Tumwebaze *et al.*, 2013; Nelson, Karver, Kullman &

Graham, 2014). It is also argued that shared facilities may not be located conveniently, making them inaccessible during the night (Kwiringira *et al.*, 2014a) and, as a result, residents can easily opt to use other methods such as open defecation or 'flying toilets'[3] (Kwiringira *et al.*, 2014a).

In principle, whether sanitation facilities are shared or not, the use of dirty sanitation facilities exposes users to the risk of health outcomes such as diarrhoea, helminth infections, trachoma and faecal-oral diseases (Fuller, Clasen, Heijnen & Eisenberg, 2014; Heijnen, Cumming, Peletz, Chan, Brown, *et al.*, 2014; Tumwebaze *et al.*, 2014).

Sanitation and gender

When sanitation facilities are not close to households, women, who have more need for privacy compared to men, may have to restrain themselves until night to relieve themselves (Kwiringira *et al.*, 2014a; Parikh *et al.*, 2015). During the night, they risk sexual harassment, domestic violence and insecurity, as reported in India (Roy *et al.*, 2014; Subbaraman *et al.*, 2014; Khanna & Das, 2015; Sahoo, Hulland, Caruso, Swain, Freeman, *et al.*, 2015; Satterthwaite *et al.*, 2015) and Uganda (Kwiringira *et al.*, 2014b). Women experience psychosocial stress because when sanitation facilities are lacking, they have to find alternatives during menstruation, bathing or post-defecation cleaning (Hulland, Chase, Caruso, Swain, Biswal, *et al.*, 2015; Sahoo *et al.*, 2015); and they are affected indirectly when they or their households (especially children) suffer from health conditions related to a lack of sanitation (Corburn & Hildebrand, 2015; Das, 2015; Parikh *et al.*, 2015). When sanitation facilities are provided and shared, women are often considered to be responsible for cleaning these facilities, mainly due to cultural and societal norms of women being caregivers (Kwiringira *et al.*, 2014b; Tumwebaze & Mosler, 2014a).

Multiplicity of actors and stakeholders

In general, the urban sanitation service chain is complex and fragmented (Medland, Scott & Cotton, 2016). Various stakeholders are involved in sanitation, including local authorities, non-governmental organisations (NGOs) and end users (Lüthi *et al.*, 2010; Galli *et al.*, 2014; O'Keefe, Lüthi, *et al.*, 2015). At the government level there is political interference, and a lack of commitment to the improvement of sanitation, manifested in laxity in the departments involved to carry out their roles and responsibilities effectively (Mara, 2012; Tukahirwa, Mol & Oosterveer, 2013; Winters, Karim & Martawardaya, 2014; Harris, 2015; Kennedy-Walker, Amezaga & Paterson,

[3] 'Flying toilet' describes the practice of defecating in a plastic bag and flinging it away.

2015). Most of the time, the various stakeholders are unregulated and lack coordination among themselves (Tukahirwa *et al.*, 2013; Galli *et al.*, 2014; O'Keefe, Lüthi, *et al.*, 2015). At the community level, informal settlements are heterogeneous, encompassing people from different ethnic backgrounds with a variety of social and cultural norms, all of which may have an effect on sanitation interventions because the different views have to be taken into consideration (Lüthi *et al.*, 2010). Due to such challenges, it may be unclear who pays for what in sanitation improvement, even at the household level.

Land tenure and sanitation-related challenges

Insecure land tenure is a critical factor for sanitation in informal settlements (Scott *et al.*, 2013; Wankhade, 2015), as it has implications for decision making for, and investment in sanitation. Due to insecure tenure, tenants, who form the majority of residents in informal settlements, may not be willing to invest in sanitation (which is a long-term investment), especially if they face the threat of eviction (Russel *et al.*, 2015). They may also be in need of sanitation facilities but have to rely on their landlords to provide these, which could result in an increase in rent (Isunju *et al.*, 2011; Mcgranahan, 2015).

The commodification of housing and petty landlordism has affected sanitation provision, as is evident from the increasing number of cases of absentee landlords who fail to provide sanitation facilities (Lüthi *et al.*, 2010; Isunju *et al.*, 2011; Banana, Chitekwe-Biti & Walnycki, 2015), yet both absentee landlords and tenants are not willing to contribute towards investment in sanitation (Appiah & Oduro-Kwarteng, 2011b; Laryea, Ampadu-Boakye, Dotse, Karikari & Gyan, 2011; Banana, Chitekwe-Biti, *et al.*, 2015). Compared to absentee landlords, owner occupiers are likely to provide and service their own sanitation facilities, and tenants living with such landlords may benefit by having access to sanitation facilities (Tsinda *et al.*, 2015). If the provided sanitation facility is within the landlord's space, however, it may be difficult for tenants to use it compared to when the toilet is in a common space (Satterthwaite *et al.*, 2015). Tenants view investment in sanitation as the landowner's responsibility, but at times these tenants end up paying for sanitation services (O'Keefe, Lüthi, *et al.*, 2015). In addition, studies have reported a lack of clear-cut roles over cleaning shared sanitation facilities, with tenants sometimes feeling that landlords are responsible because they (tenants) pay rent (Tumwebaze, 2013).

2.4.2.2 Approaches that have been used to address sanitation challenges in informal settlements

A number of activities have been taken to address the highlighted sanitation challenges:

Sanitation provision

Various stakeholders, such as governments, NGOs, Community-Based Organisations (CBOs) and residents themselves have been involved in sanitation provision interventions (Tukahirwa *et al.*, 2013; Letema *et al.*, 2014; O'Keefe, Lüthi, *et al.*, 2015). Informal non-state providers (NSP)/small-scale independent providers (SSIP), who may be skilled or semi-skilled community members, also offer sanitation services and products (Tukahirwa *et al.*, 2013; O'Keefe, Lüthi, *et al.*, 2015; Tsinda *et al.*, 2015). Community groups may also liaise with other stakeholders such as NGOs to improve sanitation conditions in informal settlements, as experienced in Dar es Salaam (Kasala, Burra & Mwankenja, 2016). Households develop their own solutions by financing, constructing and maintaining their sanitation facilities (Mazeau *et al.*, 2014; O'Keefe, Lüthi, *et al.*, 2015; Russel *et al.*, 2015). It is thus suggested that the right environment should be created for informal actors to enter and operate (Paller, 2015). Nevertheless, from a study of service provision in the peri-urban areas of Tanzania, Andreasen and Møller-Jensen (2016) caution that there should be limits to informal self-help services, because in areas where government provision is lacking, these informal services can be costly to residents.

Approaches to sanitation provision

In rural areas, sanitation provision efforts have largely been demand led, such as sanitation marketing, sanitation as a business, community-led total sanitation (CLTS), community health clubs, and behaviour change communication (BCC) (Mara *et al.*, 2010; Perez, Coombes, Devine, Grossman, Kullmann, *et al.*, 2013). These demand-led approaches have been critiqued for focusing on public health benefits when the intended target is the private acquisition of sanitation, focusing on behaviour change when the need in urban areas is infrastructural investment, and excluding households with the greatest need (those that are unable to pay) (Das, 2015; Mcgranahan, 2015; Satterthwaite *et al.*, 2015).

In informal settlements, however, sanitation provision is much more complex. As such, there has been a movement towards market-based approaches, where private stakeholders provide sanitation facilities and services and households have to pay for the services. The approaches often include alternative technologies, where the

waste is transported from the households to the decomposing or waste-recovery site. These approaches have been tested in East Africa (O'Keefe, Lüthi, *et al.*, 2015) and Haiti (Russel *et al.*, 2015). Thieme (2010) also describes a market-based approach in Nairobi's informal settlements, where a community partnership group provides professional cleaning services to communal/shared sanitation facilities in informal settlements. Provision approaches can also be in the form of construction materials loaned to households through local community groups (Kasala *et al.*, 2016).

Shared sanitation facilities

Due to the complexities in informal settlements, proposals have been made that communal facilities are the most practical and promising sanitation alternative (Schouten & Mathenge, 2010; Szántó *et al.*, 2012; Kabange & Nkansah, 2015). Hence the last few years have seen the construction of public and communal facilities in informal settlements, often with separate areas for male and female users and sometimes with extra services such as showers (Lüthi *et al.*, 2011). These have been constructed in Kenya (Thieme, 2010; Cronin & Guthrie, 2011; Szántó *et al.*, 2012), where they have commonly been referred to as biogas latrines or bio-centres[4] (Schouten & Mathenge, 2010; Katukiza *et al.*, 2012; Mutai, Niwagaba, Tumuhairwe, Kulabako, Katukiza, *et al.*, 2016; Otsuki, 2016; Simiyu, 2016), Uganda (Mutai *et al.*, 2016), South Africa (Roma, Buckley, Jefferson & Jeffrey, 2010), India (Biran *et al.*, 2011; McFarlane & Desai, 2015; Patel, 2015), and Ghana, where they are reported to be in widespread use (Appiah & Oduro-Kwarteng, 2011a; Peprah *et al.*, 2015). These facilities however have had different levels of use and satisfaction among residents.

The sharing of sanitation remains a contentious issue in the global sanitation discussion. Some argue that the classification of shared sanitation as 'unimproved' by the JMP should be revised, and that there should be a threshold such as five or more, known as 'limited sharing', which ought to be included in the 'improved' category (UNICEF & WHO, 2015). For example, Kabange and Nkansah (2015) argue that properly operated and maintained sanitation facilities shared between two or three households (depending on household sizes) should be included in the improved sanitation category. Mara also posits that well managed shared sanitation facilities count as improved sanitation especially since household level toilets are not feasible

[4] A communal sanitation initiative, usually a storeyed building, with latrines and bathrooms on the ground floor and office space on higher floors. Human excreta is stored underground and produces biogas that can be used for cooking.

in informal settlements due to lack of space (Mara, 2016). Others argue that even limited sharing has negative impacts on health and should not be considered 'improved' (UNICEF & WHO, 2015). Aside from numbers, Heijnen *et al.* (2015) add that the discourse on the classification of shared sanitation (either as 'improved' or 'unimproved') should also focus on cultural acceptability, cleanliness, accessibility, privacy and technology.

Alternative sanitation technologies

Due to the challenges of pit latrines, other sanitation technologies have been introduced, such as ecological sanitation (EcoSan) and the urine diversion dehydrating toilets (UDDT) (Mara *et al.*, 2007; Paterson, Mara & Curtis, 2007; Tumwebaze, Orach, Nakayaga, Karamagi, Luethi, *et al.*, 2011; Katukiza *et al.*, 2012; Uddin, Li, Mahmood, Lapegue, Adamowski, *et al.*, 2015). The EcoSan and urine diversion technologies have been tested in countries such as Uganda (blue diversion toilet[5]) (O'Keefe, Messmer, Lüthi & Tobias, 2015), Haiti (container-based system) (Russel *et al.*, 2015), Malawi and Zimbabwe (Banana, Chikoti, Harawa, McGranahan, Mitlin, *et al.*, 2015; Chunga *et al.*, 2016), South Africa (Roma, Philp, Buckley, Xulu & Scott, 2013), and Mongolia (Uddin *et al.*, 2015). With these technologies, urine and faeces are collected in separate containers and, once full, the urine is drained and human waste is transported to a waste composting or recovery site, or used as manure in agricultural farms.

Another alternative approach has been the peepoo bag, which is a 'self-sanitising' single-use biodegradable bag that was introduced in Nairobi's informal settlements. The aim is that the bag, which turns human waste into organic fertiliser, is used as an alternative to flying toilets (Thieme, 2010; Katukiza *et al.*, 2012).

In the midst of all these innovations, questions still arise over the most appropriate technology. While each of these innovations is believed to be appropriate, some authors recommend that simplified sewerage has the potential to serve informal settlements, although it does not offer opportunities for waste separation and nutrient recovery (Paterson *et al.*, 2007; Katukiza *et al.*, 2012; Mara, 2012). It is because of such challenges that Semiyaga *et al.* (2015) recommend that faecal sludge management in informal settlements should start at the household level, and that

[5] A kind of urine diversion toilet, developed by researchers at the Swiss Federal Institute of Aquatic Science and Technology, that includes water for handwashing, anal cleansing and a flush toilet. The waste water is recovered on site, while the urine and feces are collected in separate containers and transported to a waste recovery site. Website: http://www.bluediversiontoilet.com

technologies should be owned and operated locally, as well as be environmentally friendly, economically feasible and socially acceptable.

From the preceding discussion, it is clear that apart from the lack of sanitation facilities, there are still concerns related to financing and sanitation provision, sharing of sanitation facilities, and appropriate sanitation technologies. These concerns are related, since one concern influences the other, which in turn affects the other. The next section will therefore focus on some of these gaps in sanitation research.

2.5 Gaps in sanitation research

2.5.1 Sanitation financing

As mentioned in section 2.4.2.1, there is limited public financing for sanitation due to lack of funds as well as the low priority accorded to sanitation, hindering the scale-up and sustainability of sanitation especially in informal settlements (Isunju *et al.*, 2011, 2013; Galli *et al.*, 2014). Whilst subsidizing from the government is an option, it is noted that subsidizing may be unaffordable, and it is thus important to find private/self-financing alternatives that are sustainable (Pieter Van Dijk *et al.*, 2014). Financing for sanitation includes investment costs as well as costs of operation and maintenance (Isunju *et al.*, 2013). Since informal settlements lack access to networks such as sewer systems, and since the cost of meeting the infrastructural needs for households who are not connected to networks tends to be higher (Estache & Wodon, 2014:x), McGranahan (2015) recommends that other informal measures, such as savings groups and loans with low interest, as well as training local artisans, can help reduce the costs of sanitation for the poor households. Nonetheless, households in informal settlements provide sanitation for themselves, thus it is crucial to establish the individuals who pay for sanitation, the sanitation aspects they pay for, how much they pay, and for financing options, the users' willingness to pay (Isunju *et al.*, 2013). Most studies have used economic approaches to estimate costs of sanitation and the users' willingness to pay (WTP).

Economic approaches to estimate costs and financing for sanitation

Neoclassical economic approaches

These economic approaches to estimate the cost of sanitation are based on the premises of neoclassical welfare economics which adopt mathematical techniques for economic analysis and places emphasis on individual choices and the maximisation of utility (Agboola, 2015). The neoclassical economic approach proposes that:

- Rational individuals have preferences for goods and services and thus can best tell how well they are in any given situation.
- Individuals seek to maximise their utility by acting in their self-interest.
- Given a range of goods and services, individuals will rank their alternatives according to their self-interest and well-being, as well as maximised utility, thus resulting in their preferences and choices.
- Individuals have information about prices in the markets and can freely participate in transactions (to maximise their utility), which leads to an equilibrium in the market (Alcon & Pedrero, 2010; Flores, 2012; Freeman, 2012; Lawson, 2013; Iii, Myrick, Joseph & Catherine, 2014:7,20,26,38; Agboola, 2015).

There are two methods of economic valuation based on preferences – the revealed preference (RP) and stated preference (SP) methods. RP methods use observations of real-world choices, while SP methods use data from people's responses to hypothetical questions (Carson & Hanemann, 2005; Baranzini, Ramirez, Schaerer & Thalmann, 2008; Kling, Phaneuf & Zhao, 2012; Robbins & Daniels, 2012; Iii *et al.*, 2014:25)

In RP methods, values that individuals place on goods and services are derived from their response to the prices of these goods and services, which is a reflection of maximum utility subject to constraints (Hensher, 2010; Boyle, 2012; Freeman, 2012; Iii *et al.*, 2014:24-26,81). Types of RP methods include travel cost/recreational demand models, hedonic models, defensive behaviour models and household production models. Travel cost/recreational demand models are based on individuals' decisions to visit recreation sites differing in travel cost and quality. Hedonic models are used to estimate willingness to pay for attributes of property that consumers purchase, and defensive behaviour models are estimates of what households are willing to spend to avoid exposure to unwanted amenities (Boyle, 2012; Flores, 2012; Kling *et al.*, 2012; Robbins & Daniels, 2012; Taylor, 2012; Iii *et al.*, 2014:24-25,81).

SP methods are based on questions to respondents, who estimate their WTP for the goods or service in question, thus directly deducing preferences for these goods and services (Baranzini *et al.*, 2008; Alcon & Pedrero, 2010; Hensher, 2010). These methods are classified into contingent valuation (CV) and choice experiments

(CE)/attribute-based methods (ABM) (Baranzini *et al.*, 2008; Hensher, 2010; Flores, 2012; Freeman, 2012; Kling *et al.*, 2012; Iii *et al.*, 2014:26)

Contingent valuation (CV) is the most popular approach among the SP techniques, and it is usually in the form of a structured survey that defines a hypothetical market from which the WTP for goods and services is inferred (Baranzini *et al.*, 2008; Brown, 2012) Several formats of questioning can be used in CV studies, including open-ended questions, dichotomous choice questions, payment cards shown to the respondent with several bids on them, and bidding games (Hensher, 2010; Brown, 2012; Holmes & Adamowicz, 2012; Van Minh, Nguyen-Viet, Thanh & Yang, 2013; Thanh, Van Minh, Thi Thu Huyen, Chung & Hung, 2014). CV is commonly used to value a single good, but it also has often been used to value a number of closely related goods that differ in an attribute, thereby enabling the valuation of the attribute (Brown, 2012). Attribute-based methods are used to estimate values for a set of attributes of a good (Holmes & Adamowicz, 2012). They are used when respondents have to choose between two (binary choice) or more (multinomial choice) items to rank a number of items, or to rate items along a categorical scale (Brown, 2012; Holmes & Adamowicz, 2012). Multiple good valuation or paired comparisons is used to order preferences among a set of goods or to estimate the monetary values of goods (Brown & Peterson, 2012).

Studies using neoclassical economic methods for costing of sanitation

In order to estimate the cost of sanitation, a number of studies have used these neoclassical economical approaches, with the majority using SP methods. Thanh *et al* (2014) conducted a systematic review of studies that have used CV methods to elicit WTP for sanitation in developing countries (from 1993 to 2013). They found only twelve studies, an indication of the dearth of studies estimating demand using neoclassical economic methods. The studies (excluding those on solid waste management) were conducted in Ghana (Whittington, Lauria, Wright, Choe, Hughes, *et al.*, 1993), Vietnam (Van Minh *et al.*, 2013), Pakistan (Altaf, 1994), Burkina Faso (Altaf & Hughes, 1994), Bangladesh (Bin Seraj, 2008) and Mali (Meeks, 2012), with most of them using the bidding game approach to elicit respondents' WTP for sanitation. Table 2.1 is a summary of these studies that used the SP approach to estimate the WTP for sanitation improvement.

Table 2.1 Summary of studies estimating willingness to pay for sanitation using CV

Author	Country	Approaches used	Findings
Makaudze (2016)	South Africa	Dichotomous choice method	People living with HIV/AIDS in informal settlements showed a high WTP for sanitation, of ZAR 552.70 per month, compared to those in rural areas, who's WTP was ZAR 500.24.
Van Minh *et al.* (2013)	Vietnam	Iterative bidding	Mean WTP was 15.6 VND (Viet Nam Dong) for a bathroom with a flush toilet. WTP was influenced by economic status, health knowledge and geographical location.
Harder *et al.* (2013)	Philippines	Dichotomous choice elicitation method	Income influences WTP and demand for improved sanitation. The sewerage system required high investment costs, calling for external funding. Self-financing of the septic option was viable.
Meeks (2012)	Mali	Iterative bidding	There was demand for materials for improvement of existing sanitation facilities, as participants were willing to pay about $3.20 more for materials to build a cement slab for their latrine, compared to a pre-manufactured cement slab.
Morris and Thi Le (2012)	Peru	Bidding game	There was WTP a higher monthly fee to obtain improved sanitation facilities.
Milanesi (2010)	Tanzania	Giving respondents time to think and bidding games	WTP amount is reduced when respondents are given time to think. It was difficult for tenants to identify a starting point for an increase in the stated amounts
Bin Seraj (2008)	Bangladesh	Iterative bidding game	The mean WTP was within 1 and 2% of households' disposable income. Economic hardship hindered acquisition of sanitation facilities.
Fujita *et al.* (2005)	Peru	Dichotomous choice of two options provided to a respondent twice	WTP was higher when there was room for improvement of the current service. Those without connection to sanitation services showed a higher WTP, of 38% above the current prices. There was a need for extra financing.
Gezahegne (2003)	Ethiopia	Bidding game	Mean WTP for sewer connection was 20.48 birr/month. WTP increased with income, and subsidies from government were necessary.
Altaf (1994)	Pakistan	Iterative bidding game	Mean WTP for improved sanitation was more than the existing expenditure.
Altaf and Hughes (1994)	Burkina Faso	Iterative bidding game	The mean WTP for improved sanitation for households without sewer service was 4% of monthly household expenditure. On-site sanitation was more feasible than off-site sanitation. Multi-household compounds showed higher investment returns.
Whittington *et al.* (1993)	Ghana	Iterative bidding game	Households were willing to pay more for improved sanitation than they were paying, but not large amounts. Conventional sewerage was not affordable, requiring government subsidy.

In addition to the studies in table 2.1, O'Keefe *et al.* (2015) adopted a CV approach to elicit WTP for a new sanitation technology (blue diversion toilet) in Kampala's informal settlements. As part of the survey questions, respondents were asked to choose an alternative asset of similar monetary value in place of the new sanitation technology. They were also given the option of being on a waiting list for the new sanitation technology, or to choose the alternative asset. More people chose the asset over the toilet, even among those who were on the waiting list.

Apart from these studies that have used SP methods to estimate the cost of sanitation, other studies have also used RP methods. Most of the RP studies have used hedonic models to highlight the significance of sanitation in determining rental prices. Hedonic models are based on decisions that consumers make to purchase a house from among several choices that have different attributes (Boyle, 2012). The assumption is that the house is a bundle of attributes (such as availability of sanitation), and although the price is paid for the house as a bundled attribute, the consumer is actually paying for the individual attributes, hence a reflection of the demand for these attributes (Flores, 2012; Holmes & Adamowicz, 2012). In general, few of such hedonic studies have been conducted in informal settlements, possibly a pointer to the complexities of estimating the cost of sanitation in informal settlements. Table 2.2 summarises the studies that have employed the hedonic pricing method to highlight the effect of sanitation on rent or on housing values.

From the foregoing summary of neoclassical approaches to economic evaluation, it is apparent that neoclassical economics has been, and still is being widely used to estimate the WTP for goods and services, including sanitation. In estimating WTP for sanitation, most studies have employed SP approaches to estimate WTP as well as demand for sanitation. The fewer number of studies in informal settlements points to the complexity of estimating demand in such areas. Studies have mainly used SP methods, with little involvement of all the stakeholders involved in sanitation decision making, provision and management. These approaches are an avenue through which the price of sanitation can be estimated. However, there may be other factors and dynamics within the settlements that influence demand for and uptake of sanitation such as relationships and attitudes, hence pointing to the limitations of neoclassical economic methods in examining dynamics of payment for sanitation, especially in informal settlements.

Table 2.2 Summary of studies estimating willingness to pay for sanitation using HPM

Author	Study area	Findings/effect of sanitation
Ahmad (2015b)	Bangladesh	A dwelling with a permanent pit latrine (compared to a temporary or other form of sanitation) increased the value of a house by between 11.5% and 32%.
Choumert, Kere *et al.* (2014)	Togo	A VIP latrine increased the mean value of a celibatorium (a group of housing units) by 20.3%.
Choumert, Stage *et al.* (2014)	Rwanda	Having a toilet increased the rent by over 100%.
Van den Berg and Nauges (2012)	Sri Lanka	In-house toilets increased the value of houses by 60%.
Brueckner (2013)	Indonesia	A housing unit with its own toilet increased the rent by 14%.
Gulyani *et al.* (2012)	Kenya	Access to a shared toilet raised the monthly rent by 1.6%.
Gulyani *et al.* (2012)	Senegal	Access to a shared toilet raised the monthly rent by 19%.
Ajide and Kareem (2010)	Nigeria	Flush toilet connected to a piped sewer increased rent by 1.7%, flush toilet connected to a septic tank by 1.5%, and flush toilet connected to a pit by 5.4%.
Yusuf and Koundouri (2005)	Indonesia	Presence of a toilet led to approximately 25% increase in monthly rent in urban and rural areas.
Knight *et al.* (2004)	Uganda	Houses with flush toilets increased rent by 42.6%, while those with a latrine increased it by 26.3%.

To illustrate the limitations of neoclassical economic models, Scott *et al.* (2015) point out that levels in sanitation are difficult to assess accurately when there are other challenges (for instance, when there is an unreliable water supply it is difficult to make an assessment between a pit latrine and a sewer system). CV methods are limiting because, in such a case, they assume that people can be offered the different levels of service and they would then be able to indicate how much they would pay for each level (Scott *et al.*, 2015). They further add that the CV approaches are product focused and miss out on other factors, such as the influence of tenure status (Scott *et al.*, 2013, 2015).

In addition, other socio-economic conditions that influence payment for sanitation may arise that may not have been foreseen by economic models. For example, the Kumasi Strategic Sanitation Project (KSSP) (January 1989 to March 1994) in Ghana made use of a CV study (Whittington *et al.*, 1993) to estimate the WTP for sanitation in different areas of the city. The results of this study and project led to the

implementation of Kumasi ventilated improved pit latrines (KVIPs) and simplified sewerage in four pilot areas of the city. Due to the high costs of sanitation, households had access to loans through micro-credit facilities, with the loan being repayable monthly for two to three years. However, the recovery of these loans proved problematic because of a lack of repayment, the lack of a proper system of filing, and low connection ratios. Many loans were still outstanding long after the closure of the project (Saywell & Hunt, 1999; Salifu, 2013).

Furthermore, there are challenges in classifying sanitation in informal settlements especially when households have to pay for it. If sanitation was available for all, then it would be classified as a public good (perhaps a service). Wankhade (2015), for instance, classifies sanitation as a public good, which is beneficial if everyone has access. Tumwebaze and Mosler (2014b) are of the opinion that communal or public toilets would be classified as public goods because they are open to be used by members of the general public. However, individuals provide their own sanitation services, and it therefore could be assumed that sanitation is a private good, since it needs to be purchased, and those who cannot purchase it should be excluded from benefitting from it. This would be the stance taken by neoclassical economists, but it begs the question if this classification is practical. The practicality of sanitation as a private good lies in conditions in informal settlements, which are different across towns and even countries. Satterthwaite *et al.* (2015) note that, in urban areas, sanitation is increasingly being treated as a private good, with little or no regard for cost inefficiencies, especially in informal settlements, where household sanitation is unaffordable for many (Satterthwaite *et al.*, 2015). While making reference to the construction of communal toilets in India (Patel, 2015) as an effective alternative to the provision of sanitation, Mitlin (2015) airs similar sentiments by indicating that sanitation cannot be consumed privately in dense urban settlements. Challenges of space limit individual sanitation facilities, and the sharing of sanitation is common. Since such sharing is a reality, McGranahan (2015) refers to sanitation as a 'quasi-public good'. Willingness to pay and efforts to manage such a good therefore, may differ, as posited by economists that the WTP for private or public goods differs because of the challenges of freeriding on public goods (Carson & Hanemann, 2005; Hensher, 2010; Freeman, 2012; Kling *et al.*, 2012).

The neoclassical economic approaches may be important pointers to the valuation of goods, as well as directions for policy, but they are likely to miss some unobservable

or unmeasurable socio economic dynamics that are crucial to understanding sanitation in informal settlements. It therefore may be necessary to combine neoclassical approaches with heterodox approaches in order to obtain a better and clearer picture of socio-economic dynamics in informal settlements. Interestingly, Holt *et al.* (2011) seem to be inclined towards this position, as they state that the neoclassical economic era has ended, and that economics is moving towards the complexity era, which has evolved from the different schools of thought in economics.

2.5.2 'Software' aspects of sanitation

Aside from estimating cost and financing for sanitation technologies, it is also recommended that financing mechanisms take into account software aspects such as ownership and governance of sanitation facilities and the users of the facilities (Pieter Van Dijk *et al.*, 2014). Software aspects may include aspects such as hygiene awareness and behaviour patterns of users of sanitation facilities (Okurut *et al.*, 2015). As noted from section 2.5.1, the neoclassical approaches may not easily measure some of these software aspects. Such limitations of the neoclassical approaches in sanitation research are also reiterated by other economic discourses that challenge the neoclassical economic approach. Some of these critics are the heterodox economists.

Heterodox economic approaches

Heterodox economists is a general term referring to groups of economists including marxists, neo-structuralists, institutionalists, social economists, behaviourists, ecological economists and feminist economists, who aim at explaining the social provisioning process and economic policies and making recommendations predicated on these theories (Lee, 2009, 2012). These groups of economists emphasise the wealth of nations, justice, social relationships in class, gender and race, employment and economic reproduction, with all of these being summarised as the historical science of the social provisioning process (Lee, 2009:8, 2012).

Contrary to neoclassical economists, heterodox economists begin from and rely on reality to explain the workings of the world, thus indicating that the neoclassical approach is not a realistic depiction of the world (Lavoie, 2006:7-8). They oppose the insistence on mathematical modelling without regard for whether the models describe the real or actual situation (Dow, 2011). Heterodox economists believe that individuals are under the influence of other factors, such as the environment, culture and social class (Lavoie, 2006:8; Lee, 2009:7). Rationality is bounded or procedural;

and individuals face severe limitations in their ability to acquire and process information, which often is insufficient or non-existent. Decisions therefore are difficult to make, given that they depend on expectations of the future (Lavoie, 2006:9). Heterodox economists believe in creating resources to contribute to greater production and wealth/growth. Thus there is a surplus that causes growth and production (Lavoie, 2006:10; Lee, 2008).

In comparing the neoclassical and heterodox economic approaches, Lee (2009:1,14, 2012) highlights that although heterodox and neoclassical economists are divided along theory, methods and 'social' roles in a capitalist society, the heterodox approach is a positive alternative to the neoclassical approach, as it does not completely separate itself, but continues to engage with neoclassical economics (Lee, 2008). As such, heterodox economists present alternative but important thoughts that may be valuable in sanitation research.

Alternative thoughts of some heterodox economists

Behavioural economists posit that neoclassical economics does not measure other unobserved factors to explain the choices that individuals make (Mimmi, 2014). They suggest that individuals do not always optimise when making decisions, and that other factors influence the values that individuals place on goods and services. Social norms, for instance, may lead individuals to place a higher value on a good that may not have equivalent private benefits (Kling *et al.*, 2012). Other, unobserved factors, such as relationships between people, and perceptions and attitudes, further explain the choices that individuals make (Santos, Roberts, Barreto & Cairncross, 2011; Mimmi, 2014). Individuals have greater sensitivity towards losses, which is why they may overstate the amounts they are WTP, and thus the CV in particular is said to be poorly suited for policy recommendations (Santos *et al.*, 2011).

On maximisation of utility and rationality, Agboola (2015) notes that, although personal interests influence decisions that individuals make, other factors, such as moral values, equally have an influence on preferences, and thus rationality depends on the values that an individual holds. The neoclassical assumptions of rationality and utility maximisation thus fail to answer whether it is good when one individual's utility increases when another individual's utility decreases (Iii *et al.*, 2014:20). If all individuals were to maximise utility, then some individuals would receive less utility, ending in a dilemma; thus other avenues such as collective power are possible alternatives (Agboola, 2015).

The New Institutional Economics (NIE), a heterodox school of thought, is characterised by a number of aspects related to transaction theory, property rights, contracts, social norms, governance and bounded rationality (Eggertsson, 2013; Agboola, 2015). This approach places emphasis on the real-world dynamics of human interactions by combining economic theories with human psychological assumptions as a means to better understand economic phenomena (Agboola, 2015). It thus discards the rationality assumption of the neoclassical economists and replaces it with 'bounded rationality' (Kling *et al.*, 2012; Agboola, 2015). The approach also embraces interdisciplinary approaches, and is open to case studies and other less mathematical methodologies (Ménard & Shirley, 2014).

NIE focuses on rules created and enforced by formal and informal institutions, while highlighting the importance of social norms because the enforced rules should be compatible with the prevailing social norms (Eggertsson, 2013). The rules may be enforced by law or through social customs and etiquette, and they define property rights, which allow individuals to use, transfer or exploit property. If the rules and property rights are not defined properly, there may be damaging effects (Ménard & Shirley, 2014).

For example, in an attempt to identify conditions that prompt self-interested individuals to work towards a common end, Elinor Ostrom, a new institutional economist, challenged the rational choice theory and identified trust, reciprocity and communication as three main building blocks necessary for self-governance (Ostrom, 1998; Agrawal, 2014; Araral, 2014). Self-governance is seen as a viable solution to collective action problems of common pool resources. Common pool resources are those that have a high rivalry (subtractability) and high difficulty in keeping off potential beneficiaries (Ostrom, 2010). From these three building blocks, Ostrom develops the common pool resource management principles, which are conditions that lead to successful governance of common resources. These principles include definition of boundaries, collective choice arrangements, monitoring and sanctions (Dietz, Ostrom & Stern, 2008; Cox, Arnold & Tomas, 2010; Janssen, 2015). Individuals need to cooperate, and their cooperation depends on factors such as communication and the group size (Araral, 2014). At the community level, for instance, community governance of common resources can be done by enforcing rules and defining property rights (Ostrom, 2008, 2011; Ménard & Shirley, 2014). Defining and allocating rights involve transaction costs, however, and varies according to the mode of organisation/institution (Ménard, 2011; Harvey, 2014).

Ostrom notes that these common pool resource management principles can be used in identifying the successful and unsuccessful management systems of common resources, but it is important to study the local context and understanding socio-economic conditions (Ostrom, 2008). Wilson, Ostrom and Cox (2013) also highlight that the principles are relevant in most situations that require cooperation and coordination to achieve shared goals; and can be used as a guide to increase group efficiency. They also advise that they need to be tailored to suit the local context (Wilson *et al.*, 2013).

Sanitation studies that have adopted a heterodox approach

Just like there have been few studies applying neoclassical approaches in the valuation of sanitation, so have there been even fewer studies using heterodox approaches. Santos *et al* (2011) use principles from the neoclassical approach to estimate demand for sanitation in Salvador, Brazil. Although it may be classified as a SP method, this study goes a step further and incorporates latent variables such as attitudes and preferences, to draw conclusions on individuals' cognitive variables and how they influence their WTP for improved sanitation services. For instance, they reveal that rather than cost, households also cared about issues such as privacy and accessibility in their choice of sanitation technologies.

Such social factors and their relationship in sanitation are less mentioned in the literature. These social factors, including social ties, relations and norms, also influence how residents cope with the lack of or inadequate sanitation. Where household sanitation facilities are unavailable, the challenges posed by public sanitation facilities are still rife. Costs, distance, uncleanliness and their closure during the night prevents users (including women and children) from using them fully (Subbaraman *et al.*, 2014; Russel *et al.*, 2015). At times the toilets may be dirty, broken or not working (Lüthi *et al.*, 2011; Subbaraman *et al.*, 2014; Mcgranahan, 2015; Patel, 2015) and, as a result, they may not be effective in reducing open defecation or flying toilets (Appiah & Oduro-Kwarteng, 2011a; Biran *et al.*, 2011; Mazeau *et al.*, 2014; McFarlane & Desai, 2015; O'Keefe, Lüthi, *et al.*, 2015). Due to such limitations, the lack of space and finances for household facilities, sharing facilities among several households in informal settlements is common, and it is thus necessary that strategies for successful sharing are identified. It thus may be worthwhile to borrow from Elinor Ostrom's theory as it can reveal insights that lead

to better understanding of management of shared sanitation facilities in informal settlements

2.5.3 Decision making for sanitation

Another gap that is easily missed out and which needs to be addressed is decision making for sanitation in informal settlements. Whereas economic models lead to an understanding of preferences and choices, sanitation decisions and choices are not as straightforward as they seem from the neoclassical economic approaches, especially because of the various challenges in informal settlements. As rightly stated by O'Keefe *et al.* (2015), it is not logical to assume a perfectly rational individual in sanitation decision making, since there are other determinant factors. Such factors may be social and cultural norms within the society that determine what is acceptable or not and which eventually affect an individual's choice, the different stakeholders involved in sanitation (such as landlords and tenants), and the different roles that the stakeholders assume/do not assume (yet should assume). As such, decision making for sanitation is complex. Few studies have investigated decision making for sanitation. From a study to assess household demand for improved sanitation in Ghana, Jenkins and Scott (2007) developed a model for household sanitation adoption decision making that maps the decision making process into behavioural stages of preference, intention and choice. The study, which was carried out in the rural and peri-urban areas, highlighted that tenants rarely made decisions to install sanitation, but rather household heads were the main decision makers (Jenkins & Scott, 2007). Although this study by Jenkins and Scott is key in decision making, it reveals gaps that warrant further investigation. Intra household dynamics of decision making were not investigated, the study combined rural and peri-urban households, and the decision making process was based on the model. It is possible that in informal settlements, the decision making process may involve other individuals, and different decisions at different stages of the sanitation chain. This lacuna in household decision making for sanitation at the household level is an important area for research as it identifies decision makers, the roles they play, decisions they make, and challenges faced when making decisions. In addition, since it is noted that there are various stakeholders involved in sanitation, it may be necessary to investigate their roles in decision making at various levels, from the household to the city level.

2.5.4 Sanitation technology and land tenure

In informal settlements, since basic services including sanitation, are commodities that need to be purchased (Satterthwaite & Mitlin, 2014:5), residents rely on formal and informal markets for such purchases. One concern with purchases would be the affordability and possible ways of making sanitation affordable to everyone. The cost of sanitation is partly determined by the type of sanitation technology. Since most informal settlements lack connection to the sewer system, the poor are usually locked out of such infrastructural networks, hence their reliance on on-site sanitation systems.

The alternative sanitation technologies that have been developed have not been adopted fully due to various reasons: In Malawi and Zimbabwe, EcoSan required the education of users, and adequate monitoring of use as well as adequate maintenance (Banana, Chikoti, *et al.*, 2015). In addition, it was costly, posed operation and maintenance challenges, and was not suitable for shared households (Chunga *et al.*, 2016). In East Africa, the failure of the EcoSan has been linked to high construction costs, social and cultural beliefs on handling faeces, and lack of opportunities for the reuse of the excreta/manure (Szántó *et al.*, 2012; Simiyu, 2015). In Bangladesh and South Africa, challenges of EcoSan are linked to socio cultural acceptance, costs, maintenance problems such as smell, and consequent break down of some parts due to poor construction (Roma *et al.*, 2013; Uddin, Muhandiki, Sakai, Al Mamun & Hridi, 2014). In all these examples, what is evident is that the different living conditions influence the type of sanitation technology; the alternative technologies have high maintenance costs even though they improve the sanitation conditions; and, the cost of sanitation is determined by the type of technology. Therefore, various technologies as described in section 2.4.2.2 will continue being tested in informal settlements, and each settlement may have its own sanitation solutions.

Finally, these gaps are also influenced by tenure status. Landlords and tenants influence payment for sanitation (Isunju *et al.*, 2011), and there is need to identify the roles they each play in provision and management of sanitation facilities, as well as opportunities for their involvement in improvement. Regarding tenure and sanitation in informal settlements, a few studies and reports have alluded to the roles and responsibilities of tenants and landlords. It is generally noted that tenants consider investment in sanitation as the landowners responsibility, as shown in Kenya (Wegelin-Schuringa & Kodo, 1997) and Uganda (Kulabako *et al.*, 2010), with a study from Uganda also alluding that in terms of sanitation investments, tenants

may not have knowledge of the cost of sanitation (Ulrich, Salian, Saul, Jüstrich & Lüthi, 2016). The increasing number of tenants in informal settlements who may be living in storeyed buildings calls for different sanitation solutions (Satterthwaite, 2016). For landlords, It is also noted that it is difficult to achieve sustainable solutions when there are absentee landlords (Lüthi *et al.*, 2010).

2.5 Opportunities for sanitation improvement in informal settlements

Due to the complexities in informal settlements and the various stakeholders involved, development approaches in informal settlements require a coordinated effort and the use of multiple methods and approaches in research (Massey, 2015). Some research approaches that could be adopted include action research and transdisciplinary research (TdR); which have aspects of stakeholder involvement leading to co-production.

Action research

Action research is aimed at actively involving the researcher and members of a social setting to identify areas of concern (problem diagnosis/identification) and to develop possible solutions (Kumar, 2011:131; Bryman, 2012:397). The problem is usually one that is real and experienced by the people, for which a solution is sought, thus resulting in an improvement in the quality of service (Nieuwenhuis, 2010a:74-75; Cohen, Manion & Morrison, 2011:354; Kumar, 2011:131). It deals with answering the 'why' and 'how' questions, and may include multiple methods of both qualitative and quantitative data collection and analysis (Nieuwenhuis, 2010a:74-75; Bryman, 2012:397).

Action research requires an understanding of the context and possible solutions to the problem (Neuman, 2011:30), and it goes through cyclical stages of problem identification, identification of possible interventions, planning, implementation, monitoring, evaluation and identification of problems again, with reflection being a crucial component that ought to be done in all stages (Ebersohn, Eloff & Ferreira, 2010:127-128; Nieuwenhuis, 2010a:74-75; Cohen *et al.*, 2011:355; Kumar, 2011:131; Bryman, 2012:397).

Action research is commended for its involvement of people in problem diagnosis and solutions to problems (Bryman, 2012:397), and also that its findings may be used to raise awareness and empower ordinary people (Neuman, 2011:30). One focus of action research according to Cohen *et al.* (2011:129) is decision making.

Transdisciplinary research

Transdisciplinary research, according to the Swiss school of thought:

- Focuses on practical and societally relevant problems in real-world contexts (often denoted as wicked problems).
- Uses multiple research approaches that are specifically tailored to the research problem and its context.
- Integrates different disciplines and different stakeholders from diverse backgrounds, including actors from outside academia.
- Is action oriented and aims to create relevant knowledge oriented towards solutions to complex problems (Pohl & Hadorn, 2007; Carew & Wickson, 2010; Mobjörk, 2010; Pohl, 2011; Torkar & McGregor, 2012; Enengel, Muhar, Penker, Freyer, Drlik, *et al.*, 2012; Jahn, Bergmann & Keil, 2012; Lang, Wiek, Bergmann, Stauffacher, Martens, *et al.*, 2012; Augsburg, 2014; McGregor, 2014; Boyd, Buizer, Schibeci & Baudains, 2015; Darbellay, 2015).

TdR requires an understanding of the research context, in terms of the problem, the researcher as well as the research process itself. Researchers should be immersed in and be responsive to context; and as the research process keeps evolving, so does negotiation on the process (Carew & Wickson, 2010; McGregor, 2014). Transdisciplinarity is a research approach that is iterative, beginning with forming a research team that collaboratively frames the problem. The team then engages in collaborative research that leads to the co-production of solution-oriented and transferable knowledge – knowledge that is applicable both scientifically and in societal practice (Pohl & Hadorn, 2007; Jahn *et al.*, 2012; Lang *et al.*, 2012; Darbellay, 2015).

The process of knowledge production is often referred to as 'Mode 2', and results in scientifically relevant knowledge that is part of everyone who created it, rather than discipline or sector bound (McGregor, 2014; Polk, 2015; Rosendahl, Zanella, Rist & Weigelt, 2015). This coproduced knowledge can be classified into systems knowledge (what, why and how is the current state), target knowledge (where do we need to go, including possibilities and decision making on what needs to be done) or transformative knowledge (ways and means of how to get to the desired state/decision made) (Jahn *et al.*, 2012; Pearce, 2015; Rosendahl *et al.*, 2015).

Action and transdisciplinary research have similar research principles, i.e. the involvement of all/most stakeholders in the research process. More often than not,

these approaches focus on problems that are faced by members of the community, hence the need for involving all members. Through this involvement, there is a shared understanding of the problem and a common understanding of how the problems will be addressed.

Action/transdisciplinary research has been exemplified by research in South Africa in which there was involvement of academic researchers from various disciplines and the community towards incremental upgrading of an informal settlement (Swilling, 2014, 2016) including a sanitation intervention (Ambole, 2016). Similarly, researchers at the University of Technology in Sydney engaged designers to facilitate a social learning process in the transitioning to a more sustainable sanitation system. The research involved researchers from universities, stakeholders from the water department, health department, and stakeholders from industry (Lopes, Fam & Williams, 2012). Furthermore, participatory/action research for sanitation in informal settlements has been reported in Zambia (Kennedy-Walker *et al.*, 2015) and Uganda (Hendriksen, Tukahirwa, Oosterveer & Mol, 2011).

Stakeholder involvement for co-production

As noted, it is important that stakeholders are involved in sanitation research in ways appropriate to their interests. These stakeholders can be identified in the household, city and national domains, and include landlords, tenants, community leaders, local authorities, ministries, governments as the regulatory body, service providers (public or private), NGOs, CBOs, environmental groups and trade unions (IWA, 2014). Coordination and involvement of these stakeholders are crucial, and it can be done through approaches that are participatory, comprehensive and multidisciplinary (Lüthi *et al.*, 2010; Tukahirwa *et al.*, 2013) and that lead to co-production.

Co-production is the joint and direct involvement of public agents and citizens in the provision of services. Citizens at the local level become actively engaged so that they can participate in the collective consumption of goods and the benefits can be enjoyed by everyone (Satterthwaite & Mitlin, 2014:33-34,190,196-197). Co-production is context dependent (Satterthwaite *et al.*, 2015) and may take several forms, including community-based institutional forms of provision or management (Swilling, 2015).

Case studies of co-production in sanitation

In addition to the case studies afore mentioned, which adopted a trans disciplinary approach in sanitation, there are a few other documented studies that have incorporated elements of action/transdisciplinary research, with the involvement of stakeholders, and which have led to co-production. These have been in Pakistan, India and Zimbabwe.

The Orangi Pilot Project in Pakistan

The Orangi Pilot Project (OPP) in Karachi, Pakistan was established to understand problems that residents in informal settlements face, to develop people-centred solutions and thus to overcome constraints faced by the governments in providing solutions. Sanitation was one of the identified challenges. The main organisation, the Orangi Pilot Project–Research and Training Institute (OPP-RTI), provided communities with technical support such as training, materials and tools (Hasan, 2006, 2008; Mcgranahan, 2015). Residents were responsible for building household- and lane-level sanitation infrastructure, while the municipal authorities were responsible for building and maintaining secondary infrastructure, including mains, disposal and treatment (Satterthwaite & Mitlin, 2014:142). The community was trained and encouraged to monitor their own work and to take on additional initiatives (Satterthwaite & Mitlin, 2014:145). Self-financing created a sense of ownership and ensured that sanitation systems were functional (Satterthwaite & Mitlin, 2014:144). The project resulted in a great reduction in the unit cost of infrastructure provision, as well as scaling up to other parts of the country (Hasan, 2008; Satterthwaite & Mitlin, 2014:144,148).

Communal toilet blocks in India

In Pune and Mumbai in India, market solutions for sanitation were not possible because of high costs and a lack of space (Satterthwaite & Mitlin, 2014:196). The need for sanitation facilities led communities to get organised, design their own solutions for sanitation and construct communal toilet blocks with minimal support from the government. The community was involved at every stage of the project – from choosing the site, planning and design, to construction and supervision (Satterthwaite & Mitlin, 2014:141). The community worked closely with NGOs that could offer technical assistance, and enabled women to work together collectively for their sanitation needs (Burra, Patel & Kerr, 2003; Patel, 2015; Tomlinson, 2015).

Sanitation solutions in Zimbabwe

Through mapping, profiling and the use of geographical information systems (GIS), low-income communities in Chinhoyi were able to document their sanitation needs and to leverage strategic relationships with local government. Stakeholders were identified and selected, and had their roles and responsibilities defined. After data collection, information was presented to each settlement for feedback. During the feedback meetings, the community was encouraged to think through how it would address the identified sanitation challenges. Community representatives took an active role by mobilising members to participate in these discussions and to participate in planning the solutions. The community then formed sanitation committees that worked with city departments in addressing the sanitation challenges. The result was that selected informal settlements benefited from sanitation solutions, as some were given loans to construct sanitation facilities (such as ecological sanitation), while other settlements had their dilapidated communal toilet blocks upgraded or new toilet blocks constructed (Banana, Chitekwe-Biti, *et al.*, 2015).

Public toilets in Ghana

Harris (2015) reports on market-based public toilets in Accra that are either owned by the local government and handed to a private entity to operate, or constructed and operated by a private entity. Individuals put up public toilets and operate them as a business, mainly due to increasing demand for sanitation. Either form of management is required to pay revenues to the local government in order to operate. Allen *et al.* (2015) describe this market-based sanitation arrangement as co-production because it is a form of state-community engagement.

Benefits of approaches that lead to co-production

As seen in the mentioned examples, co-production:

- Ensures that residents (including women) are active participants.
- Strengthens the community's negotiating position by engaging governments more effectively.
- Enables communities to come together to address their needs when it would otherwise take time for the government to intervene.
- Enables communities to secure services from governments and become supervisors of their own projects.

- Reinforces collective practices and inculcates solidarity among the urban poor.
- Strengthens the local organisational capacity of groups, as well as the political competence of community leaders.
- Leads to more equitable decision making, enabling residents to come up with alternatives that have local popularity.
- Enables communities to make use of social capital and resources within the community.
- Provides a platform to reconcile differences in perspective between residents, allowing for strong collaboration.
- Leads to lower costs of services, improved service and expansion to other areas (Mitlin & Patel, 2014; Satterthwaite & Mitlin, 2014:189-190,210-214,240; Swilling, 2014; Banana, Chikoti, *et al.*, 2015; Banana, Chitekwe-Biti, *et al.*, 2015; Mcgranahan, 2015; Satterthwaite *et al.*, 2015).

Mitlin (2015) proposes that co-production is likely to be the way forward for sanitation in informal settlements, with joint ownership, joint financing and joint management of different parts of the sanitation system. Community involvement is important for sanitation improvement, because, if fully involved, residents end up being important co-producers of change (Van Vliet, Spaargaren & Oosterveer, 2011). In this regard, Van Vliet *et al.* (2011) propose the "modernised mixtures approach" as a process of involving communities in assessing the feasibility of projects, while also incorporating technical information from experts, thus co-production of sanitation solutions that can be adopted at the local level.

These alternative research approaches such as action research appreciate the diversity and wealth of information and experience of all stakeholders involved in sanitation. It is the combination of these diverse experiences and information that gives birth to solutions that have higher chances of success. These approaches therefore lead to co-production in two ways – knowledge co-production, as well as developmental co-production. It is the co-produced knowledge from the involvement of stakeholders that further leads to co-produced solutions.

Finally, having highlighted developmental issues such as the growth of informal settlements and the need to focus on sanitation from this literature review, it appears that development approaches that seem promising are those that make use of available opportunities and resources, including human resources. However, the

path towards development and progress in sanitation is full of challenges, and is presumably continuously evolving. There is more to sanitation in informal settlements than meets the eye, and one single approach is clearly not adequate. Sanitation in informal settlements therefore is a ripe area for research.

2.6 Conclusion of literature review

A number of issues have emerged from this review of the literature. Among these issues are the need to better understand conditions in informal settlements, including opportunities for improvement and barriers to the provision of services such as sanitation; the importance of sanitation in informal settlements, and how it is entwined in the social and economic dynamics of informal settlements, hence making it a complex issue; and the various challenges affecting sanitation in informal settlements. Such challenges include the economic dynamics of sanitation, social dynamics, sanitation decision-making mechanisms, challenges of shared sanitation management, and the need for alternative approaches in research. These issues may require lengthy research, which may be beyond the scope of this dissertation; nevertheless, some of them will be analysed by this dissertation. As a first step, and in order to make more meaning, chapter 3 pins the issues discussed in this chapter to a spatial context and describes the methods that were used to investigate socio-economic aspects of sanitation in an informal settlement.

CHAPTER 3: METHODOLOGY

3.1 Introduction

This chapter summarises the methods used for data collection and analysis in order to answer the research questions spelled out in Chapter 1. In order to contextualise the themes discussed in Chapter 2, the chapter begins with a general synthesis of urbanisation and informality in Kenya, before describing the study area context, data collection methods, challenges/limitations, and vital lessons learnt during data collection.

3.2 Urbanisation and informality in Kenya

Kenya is an East African country bordering Tanzania, Uganda, South Sudan, Ethiopia, Somalia and the Indian Ocean (Figure 3.1), with a land area of 582 646 km^2 (NCPD, 2013).

Figure 3.1 Map of Africa showing the location of Kenya[6]

[6]Source:https://commons.wikimedia.org/wiki/File%3AKenya_in_Africa_(disputed_hatched)_(-mini_map_-rivers).svg

Over the years, population growth in Kenya has been on an upward trend, with the annual growth rate now estimated at 2.9% (KNBS, 2010; NCPD, 2013). The estimated population, as per the 2013 situational analysis report of the National Council for Population and Development (NCPD), is 42 million, comprising largely those between 15 and 65 years. The population is expected to reach 60 and 77 million in 2030 and 2050 respectively (KNBS, 2010; NCPD, 2013).

The country has been experiencing rapid urbanisation, with the 2009 national census indicating that 32% of the population lived in urban areas, which is an increase from 19.3% in 1999 (KNBS, 2010; NCPD, 2013). The urban population growth has accelerated and it was expected that about 50% of Kenya's population would be living in urban areas by 2015 (Syrjänen, 2008; UN-Habitat, 2010: 16–17; NCPD, 2013). The main cities in the country are Nairobi (the capital), Mombasa and Kisumu, all of which have aspects of urban poverty (NCPD, 2013). One of these aspects is the expansion of informal settlements, mainly due to the growing urban population. Other factors, such as high cost of living, non-transparent land allocation systems and land grabbing, non-inclusive planning, as well as governments' and local authorities' inability to provide essential services, have accelerated the expansion of informal settlements (Syrjänen, 2008; Mutisya & Yarime, 2013; NCPD, 2013). In addition, according to Mutisya and Yarime (2013), the change in urban governance over the years – from British rule to the democratically elected governments – has failed to address the core problems of urban development. It is estimated that 60 to 80% of the urban population in Kenya lives in informal settlements (Syrjänen, 2008). The capital city (Nairobi) hosts approximately 3.1 million people (KNBS, 2010), and an estimated two million of these (or 60% of the total population of the city) live in informal settlements, which occupy only 5% of the total residential area (Syrjänen, 2008; Amnesty International, 2009). Nairobi has several informal settlements, such as Kibera, Mathare, Korogocho and Mukuru Kwa Njenga.

According to the JMP, in terms of sanitation there has been limited progress in Kenya, as only 18% of the population has gained access to improved sanitation since 1990 (UNICEF & WHO, 2015). The 2015 JMP report notes that only 30% have access to improved sanitation, and 27% use shared sanitation facilities. In the urban areas, 31% have access to improved sanitation and 48% share sanitation facilities (UNICEF & WHO, 2015). The traditional pit latrine is the most common sanitation facility, used by 74% of the population in rural areas and 63% in urban areas, and the sewer

system serves only 20% of the population in urban areas (KNBS, 2010). A lack of sanitation is also common in informal settlements in the country.

3.2.1 Developmental concerns in Kenya's informal settlements

Informal settlements in Kenya are characterised by overcrowding, lack of basic infrastructure (such as safe water, sanitation and housing), and high levels of poverty (NCPD, 2013). As such, they have attracted attention from governmental and non-governmental organisations, as well as researchers. They are faced with conditions and challenges such as a lack of service delivery, including water and sanitation (Schouten & Mathenge, 2010; Cronin & Guthrie, 2011; Mutisya & Yarime, 2011), poor housing and living conditions (Gulyani & Talukdar, 2008; Gulyani *et al.*, 2012; Mwangangi & Simiyu, 2014), thriving informal networks and businesses (Gulyani & Talukdar, 2010; Cronin & Guthrie, 2011), and poor health conditions (Corburn & Hildebrand, 2015).

Residents often have to pay more for basic services such as water and sanitation (Amnesty International, 2009; Cronin & Guthrie, 2011) and, for sanitation, residents in informal settlements either use flying toilets, share pit latrines, or pay to use communal facilities that have been introduced by developmental agencies (Amnesty International, 2009; Schouten & Mathenge, 2010; Cronin & Guthrie, 2011; Mutisya & Yarime, 2011). The manual emptying of pit latrines into drainage channels is a common occurrence in these informal settlements (Amnesty International, 2009).

3.2.2 Approaches to improve conditions in informal settlements in Kenya

Efforts to improve living conditions in informal settlements have largely been through relocation or upgrading, with forced evictions being reported in some of Nairobi's informal settlements (Amnesty International, 2009).

The upgrading of informal settlements in Nairobi has been hampered by various factors, such as housing being too costly for the poor, petty landlords who rent out their structures to (urban poor) tenants, political interference, conflicts between landlords and tenants, lack of adequate land, competing stakeholder interests, and middle-class individuals who cannot afford to buy homes in the city but buy out housing projects intended for the poor and rent them out to other poorer tenants (Huchzermeyer, 2008; Cronin & Guthrie, 2011; Muraguri, 2011). In spite of these challenges, positive aspects have been initiated by governmental and non-governmental bodies.

The Kenya Slum Upgrading programme (KENSUP) was launched in 2004, and is implemented by the ministry of housing and supplemented by UN-HABITAT. It aims to have improved the lives of at least 5.3 million slum dwellers countrywide by 2020, and is being implemented in Nairobi, Kisumu and Mombasa. The programme hopes to achieve its aim through strategies such as tenure regularisation, participatory preparation of development plans, installation of services and infrastructure, and the development of housing (Syrjänen, 2008; Amnesty International, 2009; Cronin & Guthrie, 2011). The KENSUP pilot project began in Kibera's Soweto East and involved the temporary relocation of about 25 000 residents to a new site while new houses were built in Soweto East. On completion of the upgraded houses, the residents would move back to their old site on the basis of their ability to afford owning or renting the new units (Amnesty International, 2009).

The Kenya Informal Settlements Improvement Project (KISIP) is another effort and is a collaboration between the Kenyan government, the World Bank (WB), the French agency for development (AFD) and the Swedish International Development Agency (SIDA). The project began in 2011 and is expected to be operational for five years. It aims to improve living conditions in informal settlements by investing in infrastructure, enhancing tenure security, strengthening the relevant stakeholders, and planning for urban growth (Muraguri, 2011).

In spite of these efforts, residents of the informal settlements have raised concerns about the affordability of the new housing, the lack of informal avenues of survival in the new sites compared to the informal settlements, fear of being cut off from means of survival, fear of being excluded from upgrading efforts or being evicted, and the lack of guarantees of being relocated back to the settlements (Amnesty International, 2009; Omambia, 2010). In Kibera East, for example, the residents were not happy with the resettlement project because of the resultant change in their way of life, therefore did not move into the new houses. Resultantly, the pilot project in Kibera was not very successful. After this realisation, KENSUP shifted its focus to the provision of basic services and infrastructure (Otsuki, 2016).

On their own, residents in informal settlements have also taken initiatives to improve their living conditions. Through collective action, more residents have become empowered and have formed lobby groups to claim land ownership from the government, or have provided facilities for themselves that the government has not been able to provide such as housing (Omambia, 2010). The youth in these settlements join together to bring positive change through community-based

organisations that are actively involved in activities such as garbage collection, urban agriculture, recycling of waste, mentoring and empowering children, and cleaning community toilet blocks (Thieme, 2010; Darkey & Kariuki, 2013). In Kibera, CBOs have actively been involved in the co-production, operation and maintenance of communal sanitation facilities/bio-centres (Otsuki, 2016).

Generally, most of these initiatives have been done in Nairobi, with Kibera being a major focus of development interventions. However, as mentioned in section 1.2, Kisumu is estimated to have the highest proportion of residents living in informal settlements, which therefore makes it a prime area for research.

3.3 Urbanisation, informality and sanitation in Kisumu (study area)

Kisumu city is in Kisumu County, in the western region of Kenya (Figure 3.2).

Figure 3.2: Location of Kisumu city in Kenya[7]

[7] Source: http://www.wiredinternational.org/img/Map_Kisumu-Kenya.jpg

It is the third largest city in the country, with an estimated population of 420 000 people (Republic of Kenya, 2013). Over the past years, the city's population has grown rapidly, resulting in common urbanisation challenges including the growth of informal settlements. More than half of the city's population lives below the poverty line (UN-Habitat, 2005), and among the cities in Kenya, it has the highest proportion of residents living in informal settlements – estimated at between 47 and 60% (Syrjänen, 2008; NCPD, 2013).

The informal settlements in Kisumu city are Manyatta A and B, Manyatta Arab, Nyalenda A and B, Bandani, Kaloleni, Obunga and Kibos. Nyalenda is the largest informal settlement, hosting a vast majority of the city's urban poor. Manyatta, on the other hand, has a mix of people of varying economic levels (UN-Habitat, 2005). A map showing the informal settlements within the city is shown in Figure 3.3.

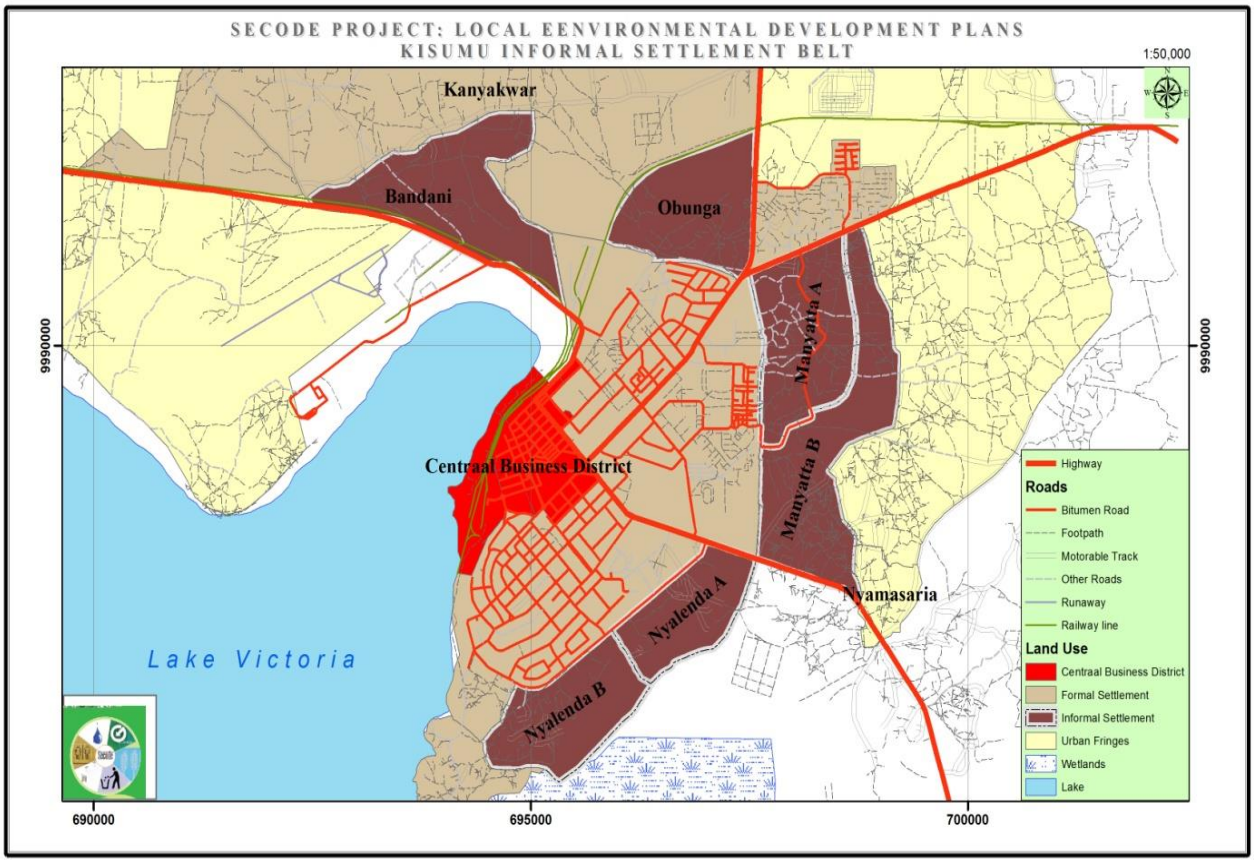

Figure 3.3 Kisumu's informal settlements[8]

[8] Source: SECODE project, Kisumu

These settlements have characteristics such as poor housing units, a lack of sanitation facilities, and poor waste disposal (UN-Habitat, 2005). They are divided into clusters (commonly called units), which have been especially useful for development efforts. Nyalenda A, for instance, has Central, Kanyakwar, Western and Dago clusters (SECODE, 2011a); Nyalenda B has Kilo, Dunga, Got Owak, Western and Nanga clusters (SECODE, 2011b), and Obunga has Central, Kasarani, Kamakowa and Sega Sega clusters (SECODE, 2011c; Dickson, Otor & Afullo, 2015). Most residents in the settlements are tenants who commonly live in compounds. A compound is a group of several tenant households, living in individual housing units which are all under one landlord. More often than not, these housing units are constructed next to each other and they share a common yard.

In the past years, there has been less focus on sanitation in the informal settlements of Kisumu, and consequently, little documentation. The available literature points to a general lack of sanitation, but with little focus on socio economic dynamics such as land tenure dynamics, cost of sanitation, management of the available sanitation facilities, and decision making processes (as will be discussed in chapters 4 through 7). This lack of documentation and the high proportion of residents living in informal settlements served as an indication of little development efforts in the settlements, particularly for sanitation, and was thus a motivation for the choice of Kisumu city's informal settlements as a study area.

Having described the study area, the following sections will describe the methods used to address the research objectives that were spelled out in Chapter 1; more specifically, the data collection and management procedures, ethical considerations, quality assurance procedures, as well as challenges and lessons learnt during field work.

3.4 Overall research design

A research design describes the procedures for data collection and analysis, which should then answer the research questions validly, objectively, accurately and economically (Kumar, 2011:94; Bryman, 2012:715). Due to the various challenges facing sanitation in informal settlements, a thorough investigation requires reflection, follow up and the use of multiple methods, hence a mixed-methods approach was deemed the most appropriate to answer the research questions. A mixed methods research design is useful when one data source is not sufficient and there is a need to obtain a more comprehensive view of the research problem, or when there is a need to understand the research objectives through multiple

research phases (Creswell & Clark, 2011:11; Creswell, 2015:15), as was the case in this study. Specifically, this study adopted an explanatory sequential mixed methods design that began with a quantitative phase, some initial data analysis, and then a qualitative phase. The two phases built on one another, with the qualitative phase explaining the results of the quantitative phase (Ivankova, 2006; Teddlie & Tashakkori, 2006; Creswell, 2012:552, 2014:224, 2015:38; Klassen, Creswell, Plano Clark, Smith & Meissner, 2012). The first two objectives and part of the third objective were answered by a quantitative phase, which led to a qualitative phase that answered the third and fourth objectives. The procedures undertaken in answering these objectives are detailed in the following sections, with more information in Chapters 4 through 7.

3.5 Research methods per objective.

3.5.1 Objectives 1 and 2: Assessment of living conditions and estimating cost of sanitation

Study design

In order to assess living conditions and estimate the cost of sanitation in the informal settlements, a cross-sectional study design was adopted.

Sample size

Sanitation, being the main aim of the research, was used as a proxy for calculating the sample size. Calculating the sample size required the following parameters:

- The α (alpha), which is the standard normal deviate corresponding to the selected significance level
- Statistical power, or β
- The minimum expected difference or expected effect size (d)
- Standard deviation (δ)

The parameters were substituted in the formula

$$n = \frac{2[Z\alpha + Z1-\beta]]^2\ \delta^2}{d^2} \qquad (i)$$

(Kadam & Bhalerao, 2010; Noordzij, Tripepi, Dekker, Zoccali, Tanck, *et al.*, 2010)

The significance level in most studies is usually set at 95%, corresponding to a value of 1.96, although other levels such as 99% can be used (Cohen *et al.*, 2011:616-618). There are no formal standards for power, and a power of 80% is generally considered adequate (Gavin, 2008:98). However, a higher power means that there is a likelihood of finding a statistically significant cause-and-effect relationship (Picardi & Masick, 2014:178), due to a greater sample size brought about by increasing the power

(Jackson, 2009:181). In this study, the alpha level was set at 95%, but the power was increased to 90% (corresponding to the value 1.28) in order to increase the sample size, thereby increasing the representativeness of the sample to the population.

Based on preliminary findings (Simiyu, 2015), the expected difference was calculated as the difference between compounds with sanitation facilities and those without sanitation facilities, which was 27.8. Similarly, the standard deviation, between those with and without sanitation facilities was 0.48. Therefore, based on equation (*i*), the sample size was $2[1.96+1.28]^2 0.48^2/0.27^2$ =67 compounds from each category (with sanitation and without sanitation).

The sample size was adjusted for a non-response rate of 20%, thus increasing the sample size to 80 compounds per group. The required calculated sample size therefore was 160 compounds.

Sampling process

1. *Selection of informal settlements*

Priority was given to settlements that would give a true representation of informal settlements in Kisumu city. During the preliminary studies it was noted that Kaloleni, Kibos and Manyatta Arab had very few households, while Manyatta had residents with better living conditions than the other settlements. These settlements therefore were left out and Nyalenda A, Nyalenda B, Bandani and Obunga were selected. Because of a lack of data on the number of compounds in each of the informal settlements, the four selected settlements were treated as four strata (as in stratified sampling), since the population is heterogeneous. The sample size was then divided equally among the four settlements (Maree & Pietersen, 2010a:175-176), thus 40 compounds from each settlement.

2. *Selection of clusters*

There is little documentation about the clusters in the informal settlements, aside from recent studies by non-governmental organisations. Due to this limitation, transect walks with community 'gatekeepers' were carried out to identify the boundaries and characteristics of the clusters. It is recommended that researchers identify and gain access from such gatekeepers, since they may influence the research process to the extent of restricting entry into the research field (Cohen *et al.*, 2011:168; Neuman, 2011:429-430). Since this research would involve interaction

with community members and the use of multiple methods, it was deemed necessary to involve gatekeepers as early in the study as possible. The gatekeepers were recognised leaders (with or without a formal title) in the community who worked closely with development partners and therefore had a fair knowledge of development issues and boundaries within the settlements.

Each of the four selected settlements had at least four clusters, and two clusters from each settlement were selected randomly, with the rest of the clusters being left to be used during the subsequent stages of data collection. In Nyalenda B, Kilo and Western clusters were selected, while Central and Kanyakwar clusters of Nyalenda A were selected. From Obunga, Central 1 and Central 2 were selected, and in Bandani, Centre and Pundo were selected. The required sample size (40 compounds) was then divided among the two clusters in each settlement, thus twenty compounds from each cluster.

3. *Selection of compounds*

The transect walks were crucial in estimating the approximate number of compounds which was used to calculate the sampling interval as:

$$\frac{Estimated\ total\ number\ of\ compounds\ in\ each\ cluster\ (N)}{Required\ sample\ size\ from\ each\ cluster\ (n)}$$

This calculation of a sampling interval is used when the population size is not known (Maree & Pietersen, 2010a:174-175).

In most clusters, the sampling interval was four, except in Bandani, where the interval was three compounds. The required sample size was divided into ten compounds with sanitation facilities and ten without sanitation facilities. Research assistants worked in groups of two, with each pair selecting compounds from one category only (e.g. compounds with sanitation facilities only) to ensure that efforts were not duplicated. Compounds were selected by beginning from one end of each cluster and moving towards the other end while systematically skipping the sampling interval. In order to avoid suspicion, one pair began their selection from one end of each cluster while the other pair began from the other end. The assistants moved in a zig-zag manner to ensure that all corners of the cluster were combed through. This process of selection continued until the target number was achieved.

4. Selection of respondents

Upon arrival in each compound, it was first established whether there was a live-in landlord or caretaker[9] and, if he/she was present, permission was sought to select and interview tenants in the compound. Inquiries were also made about the total number of households and the availability of sanitation facilities in the compound. In the event that the compound had neither a live-in landlord nor a caretaker, assistants noted the presence or absence of sanitation facilities, determined the total number of households in the compound (by counting), and assigned each household a number.

To select respondents, the fishbowl draw method, usually applied when the population is small, was used. The method entails writing numbers that represent each element in the population on separate slips of paper (in this case a number representing each household in the compound). The pieces of paper are put in a bowl (or something similar), and pieces are drawn out one by one without looking (Kumar, 2011:200). The simple random with replacement sampling technique (Kumar, 2011:202-203) was used to select households, and if the selected household refused to participate, their corresponding number was returned to the bowl and another number was selected. After the identification of the households, the interviewers introduced themselves to the respondent and explained the purpose of the visit. Consent to participate in the study was sought and, once granted, the interview began. Interviewed respondents had to be tenants who were adult heads of the household (or their spouses).

5. Data collection tool

Some authors refer to a questionnaire as the data collection tool most commonly used in surveys (Maree & Pietersen, 2010b:158; Picardi & Masick, 2014:156-157); while others (Neuman, 2011:344; Bryman, 2012:212) name the tool as a structured interview guide. The main difference is the mode of administration. Both perspectives agree that the tool is designed with closed or open-ended questions for the sake of answering the research objectives. In this phase, a structured interview guide was used as the data collection tool. The tool had a section to capture details of the cluster, the names of the interviewers, and various aspects that described the living

[9] These are persons, often tenants, who are appointed by a non-resident landlord to be in charge of the rental premises by acting as point persons between the tenants and the landlord.

conditions. The measurement variables in the data collection tools are described in Chapters 4 to 6, and the tool is in Appendix 2.

The tool was not translated into the local language because the settlements are cosmopolitan with various ethnic groups. Nevertheless, research assistants were trained on how to administer the data collection tool. During these training sessions, each question was translated into the dominant local language (Dholuo) in order to pre-test how the questions would be asked should there be a need for translation.

6. *Piloting/pre-test*

A pre-test study was conducted in Dunga cluster of Nyalenda B, which was selected because it has similar characteristics as the other clusters, although it is at the farthest end of Nyalenda B. The aim of pre-testing the tools was to identify problems in the wording of the questions, test whether or not the respondents understood and interpreted the questions in the same way (Kumar, 2011:158-159), ensure that the interviewers were familiar with the questions in the tool (Neuman, 2011:312), and increase the validity, reliability and practicability of the tool (Cohen *et al.*, 2011:402). Respondents from 28 compounds were interviewed, 16 of which had sanitation facilities and 12 which lacked sanitation facilities. Afterwards, some questions that were not clear were corrected.

7. *Data collection methods*

The tool was administered face to face. Face-to-face administration of a structured interview has high response rates due to real-time data collection, it allows the interviewer to clarify questions, it is suitable for respondents who cannot read or write, and it ensures that only the respondent answers the questions without getting help from others (Maree & Pietersen, 2010b:158; Cohen *et al.*, 2011:274; Picardi & Masick, 2014:156-158). Research assistants were familiar with the tool and since they worked in pairs, one individual conducted the interview while the other listened to the responses and completed the tool. The interviews were conducted in the language preferred by the respondent, which was either English, Swahili or Dholuo. If the compound had sanitation facilities, interviewers inspected the facilities after the interview, using an inspection sheet (Appendix 3), and also took photographs of the sanitation facilities for illustration (Bryman, 2012:456-457,547-548).

3.5.2 Objective 3: Socio-economic determinants of shared sanitation quality

The second phase of data collection began after the cross-sectional study, as the initial data analysis revealed the need for further qualitative studies to investigate how and why the quality of shared sanitation facilities varied in the informal settlements. The common pool resource management principles were used as the guiding theoretical framework.

Study design

A case study design, with qualitative and quantitative methods, was adopted to answer the how and why questions regarding the quality of shared sanitation facilities in the settlements. A case study was selected because it aims at a comprehensive understanding of the case(s), as well as interacting with specific real-world contexts (Nieuwenhuis, 2010a:75-76; Flyvbjerg, 2011; Kumar, 2011:126; Bryman, 2012:66-68; Yin, 2014:16). A case study helps to identify boundaries between the case and the context, which might not be clearly evident normally, and thus helps to link the micro-level actions to the macro-level processes (Silverman, 2010:138; Cohen *et al.*, 2011:289; Neuman, 2011:42; Yin, 2014:16), as was the case in this phase. Since contexts are unique and dynamic, case studies investigate the real-life, complex, dynamic and unfolding interactions, thus establishing the cause and effect (how and why) (Cohen *et al.*, 2011:289). Specifically, this was a multiple case study design, sometimes referred to as a collective case study, in which a number of cases are studied in order to investigate a general phenomenon (Silverman, 2010:139; De Poy & Gitlin, 2011:311). According to Yin (2014:57), multiple case studies are beneficial in that the cases might predict similar or contradicting results.

Case definition

Yin (2014:34) points out that in a case study design, the case should be some real-life phenomenon that has some concrete manifestation, and it may be an individual, a group, a neighbourhood or an organisation. The case should also be "bounded", which means that it ought to be distinguished from other cases outside it, and must be a separate entity in terms of place and time (Yin, 2014:34). Bounding also means defining the time period, social group or geographic area, the type of evidence to be collected, and priorities for data collection (Yin, 2014:33-34). The cases in this study were shared sanitation facilities which were inspected in order to understand their quality (as the manifestation). The study was only limited to sanitation facilities that

were shared by at least two people, and only within Kisumu's informal settlements (the context).

Theoretical framework

In a case study, the theory is more often defined and developed prior to data collection in order to guide data collection and analysis (Yin, 2014:17). Case studies capture complexity, consider many actors and interactions among them, enable researchers to adjust abstract concepts to dependable or concrete standards, and therefore enable elaboration by telling a larger story that can help reshape existing theories (Nieuwenhuis, 2010a:75-76; Flyvbjerg, 2011; Neuman, 2011:42). In this study, the theory behind the management of common-pool resources was adopted to study shared sanitation facilities (as the common resource).

Sample size

In multiple case study designs, the guiding principle for sample size determination should be the number of (literal and theoretical) case replications that are needed, and thus judgment is usually at the researcher's discretion (Yin, 2014:61). Such judgement however, should be guided by the strength and importance of rival explanations (Yin, 2014:61). On the other hand, Kumar (2011:212-213) highlights that in qualitative research the main aim is to explore diversity, thus data collection is done without a predetermined sample size, but rather continues until no new information is forthcoming or such information is negligible (data saturation). Theoretical saturation happens when new data cease to emerge, categories are well developed in terms of properties and dimensions, and relationships among categories are established (Cohen *et al.*, 2011:161; Bryman, 2012:421,425; Green & Thorogood, 2014:217) Theoretical saturation is achieved by having 'enough' cases to support theoretical propositions, and it requires choosing cases as determined by the theory, paying attention to deviant cases, and at times it may lead to changing the size of the sample in the course of the research (Silverman, 2010:143-146).

What can be summarised from these viewpoints is that the required sample size varies from situation to situation, but it should be 'large enough' to achieve data saturation and provide thick description, but not 'too large' to make it difficult to undertake deep analysis; the sample also should be adequate to support convincing conclusions (Cohen *et al.*, 2011:162; Bryman, 2012:421,425). Being a multiple case study design, the study did not have a predetermined sample size for the qualitative phase, but rather sought to get as much diversity and replications as possible. The

replications helped to gain a thorough understanding of the complex dynamics within the settlements that influence the quality of shared sanitation facilities, hence developing a solid explanation and argument.

Sampling

Since the aim of case studies is to select cases that will provide as much information as possible, sampling is usually purposive or judgemental, since the case provides insights into events and situations from where it is drawn (Silverman, 2010:141; Kumar, 2011:126-127). The following procedures were applied in sampling:

Selection of clusters, compounds and respondents

Since the aim of this phase was to further investigate aspects that arose from the first stage of the cross-sectional survey, qualitative data were collected from the same settlements and clusters as the first phase. Compounds were also selected by beginning from one end of the cluster and moving to the other end. However, since the focus was on shared sanitation facilities, only compounds with at least two households sharing sanitation facilities were selected, while ensuring that the compounds that had been selected during the survey were not selected again. Being a multiple case study, the aim was to have as much replication and variation as possible, and to achieve saturation. After combing through each cluster, more compounds were selected from the next immediate clusters if it was felt that there was a need for more data. Thus, in Obunga, more compounds were selected from Kasarani; and in Nyalenda A and B, more compounds were selected from Western and Got Owak respectively.

In every compound, the first consideration was given to live-in landlords or caretakers as respondents, because there was a need to get views from them as 'leaders' in the compound, and especially since it had been determined from the first phase that most residents were tenants. In compounds where neither landlord nor caretaker was present, one tenant was selected randomly. The process continued in the four settlements until it was felt that new information was not forthcoming, by which time 40 respondents had been interviewed and their sanitation facilities inspected.

Piloting

In a case study design, a pilot study (not a pre-test), which is more like a formative study, assists in the development of questions and clarification of concepts (Yin, 2014:96). In this regard, a pilot study was conducted in ten compounds in the

Western cluster of Nyalenda B. The aim of the pilot study was to assess the applicability of the common pool resource management principles to shared sanitation, and to develop appropriate questions for interviews. Data was collected by non-participant observation and through the use of visual aids (photographs and videos) in compounds with shared sanitation facilities.

Data collection methods

Since case studies may have many more variables of interest, more than one method of data collection is required (Yin, 2014:17), with each of these methods converging in a triangulating fashion (De Poy & Gitlin, 2011:310; Kumar, 2011:126-127; Yin, 2014:17). In general, it is noted that mixing methods leads to a robust understanding of the research question, as it minimises the weaknesses and maximises the strengths of each data collection method used (Klassen *et al.*, 2012; Creswell, 2014:218), and further helps in the triangulation of the results (Flick, 2008:40-41; Bryman, 2012:717).

A number of methods were used to collect data:

1. Semi-structured interviews with users of shared sanitation facilities

In order to gain a deeper understanding of the management practices of users of shared sanitation facilities, semi-structured qualitative interviews were conducted with tenants, landlords and caretakers, since each of them had a role to play in management. Interviews are useful in providing in-depth personal accounts and rich descriptive data (Lambert & Loiselle, 2008; Reed, Graves, Dandy, Posthumus, Hubacek, *et al.*, 2009; Bryman, 2012:482), and more specifically semi-structured interviews that have pre-determined questions allow for the probing and clarification of answers, thus allowing the researcher to see other lines of inquiry that might have been missed (Nieuwenhuis, 2010a:87-88). Working in pairs, one research assistant conducted the interview while the other recorded the interview using an audio recorder. Using a recorder saved time, allowed interviewers to have a thorough examination of what respondents say, allowed the interviewers to observe body language, to be attentive and probe, and prevented the respondent from being distracted (Nieuwenhuis, 2010a:87-88; Silverman, 2010:199; Bryman, 2012:482; Green & Thorogood, 2014:120).

2. Visual inspection of shared sanitation facilities

All the shared sanitation facilities whose users were interviewed were also inspected in order to assess their quality.

3. Photographs

Apart from inspecting the sanitation facilities, photos were also taken to obtain a visual record of the quality that was recorded in the inspection tool. Photos are illustrative sources of data, although it is recommended that they should be accompanied by other methods such as interviews, as they can be interpreted differently by different people (Bryman, 2012:456-457,547-548).

4. Observation

Observations were mainly conducted during the pilot phase, although the characteristics of the compound, such as number of households and sanitation practices of shared sanitation users, were also observed during the data collection phase.

Data collection tool

A semi-structured interview guide (Appendix 4) was designed with questions relating to the management of sanitation facilities at the compound level, as per the common-pool management principles. The principles were reviewed to suit the local context and sanitation, as detailed in Chapter 6.

The tools were pre-tested in Dunga cluster of Nyalenda B. The main aim of the pre-test was to ensure that the research assistants were familiar with the tools, and that the respondents understood the questions. The tools were tested in eleven compounds with shared sanitation facilities.

3.5.3 Objective 4: Decision making for sanitation

This phase arose from the previous phases, and the aim was to examine decision making for sanitation at the household level (point of use of sanitation facilities), community level, as well as the city/planning/policy-making level. Stakeholder involvement, including that of the community, was deemed crucial in defining the problem and proposing solutions.

Study design

This stage borrowed concepts from action and transdisciplinary research to understand and facilitate a decision-making process for sanitation in the informal settlements. This phase of the research was carried out in three stages:

Stage one: Compound/ household-level decision making: Interviews with household heads

The aim of this first stage was to investigate the key sanitation decision makers at the point of use, and how sanitation decisions were made.

Sample size

The same principles of saturation in qualitative research were applied, and as such the guiding principle was to collect enough data to give an adequate description of decision making for sanitation at the point of use. Thus, there was no pre-determined sample size, but rather it grew to the point of saturation.

Selection of settlements, clusters and compounds

Data collection was carried out in Nyalenda A, Nyalenda B and Obunga. Bandani was not included because it was felt that all the compounds had been selected in the previous phases. Data were collected from clusters that had been excluded during the first phase of the study, but which had a higher population density with a mix of landlords and tenants. Western in Nyalenda A, Got Owak in Nyalenda B and Sega Sega in Obunga were thus selected for this stage of household interviews. The same strategy of moving from one end of the cluster to the other end was employed, and since the aim was to understand decision making, compounds were selected irrespective of whether they had sanitation facilities or not.

Selection of respondents

When available, caretakers and live-in landlords were interviewed first, after which the assistants moved to the next compound. When only tenants were available, an adult tenant from the compound was selected and interviewed. A few absentee landlords were also identified and interviewed. Interviews continued until it was felt that new information was not forthcoming, by which time 39 interviews had been conducted, five of which were with absentee landlords.

Data collection methods and tools

Just like in the previous phase, the research assistants worked in pairs, with one person leading the interview and engaging the respondent, while the other participated by audio recording the interview, observing the respondent's body language, and probing for clarification. The interviews were guided by an unstructured interview guide, which covered questions relating to sanitation

decisions made, how they were made, and who made them. The various tools used for the different respondents are in Appendix 5.

Pre-test

The tool was piloted in seven compounds in Nanga (Nyalenda B). The pre-test was done to test if the questions were clear to both the respondent and the interviewer, and also to ensure that the interviewers had familiarised themselves with the data collection tool.

Stage two: Community-level decision making: Group discussions with community members

The aim of this stage was twofold: to further investigate decision making within the informal settlements, and to initiate a decision-making process in which community members identified sanitation challenges, as well as solutions (appropriate sanitation technologies).

Participant selection criteria

Based on the experience in the previous phases of the research, a selection criterion was developed based on tenure type (landlord/tenant) and availability of a sanitation facility in the compound, as it was felt that each of these groups had different but critical views in the decision-making process. This criterion led to eight categories of respondents that were used to select study participants; such as landlords from compounds with tenants and who lacked a sanitation facility, and tenants of absentee landlords who had or lacked a sanitation facility. More on these categories is detailed in Chapter 7.

Selection of compounds and participants

Participants were selected from all clusters of Nyalenda A, Nyalenda B and Obunga. The selection was carried out a few days before the planned date for the discussion to ensure that participants received the notice early enough, while at the same time not too early for them to forget about the meeting.

Upon arrival at a selected compound, the assistants verified if the compound met the criteria of interest at the time (e.g. with a live-in landlord and without a sanitation facility). If it did, one respondent was selected. The purpose of the upcoming discussion was explained to the selected participant, after which he/she was asked for his/her consent to participate. If the compound did not meet the criterion of interest, or if the selected participant did not consent, we moved on to the next

compound. If the selected participant gave consent, his/her name and phone number were noted, and they received a letter with details of the meeting (date, time, venue, and contact details of the community leader and researcher). At least twenty participants in each category were invited on the assumption that not all would turn up for the meeting; as it is recommended for a 20 to 25% over-recruitment for focus group discussion (FGD) participants (Cohen *et al.*, 2011:437; Green & Thorogood, 2014:143). The selected participants were invited to a common venue within the settlements where the group discussions were held.

Conducting the discussions

After the participants were settled at the venue, the discussions began with a skit as an 'ice breaker', since it was felt that the topic of discussion was a 'sensitive' topic. Sensitive topics are any topics that people believe threaten their presentation of themselves, such as topics that are socially unpopular (Neuman, 2011:320), and in order to get responses from the respondents, comfort and trust should be created and a desensitising context should be established (Neuman, 2011:320-321).

The skit portrayed common issues faced by respondents in the selected category, and also depicted a decision-making dilemma. The use of a skit was borrowed from what Cohen *et al.* (2011:512-513) describe as role playing as a strategy of data collection, which can be used to explore choices and moral dilemmas. According to these authors, role play is different from theatre because the person taking up the role is not required to have elaborate acting skills, but rather to present a point of view. Other authors have referred to theatre for development (TfD) as a strategy to explore issues directly related to the community (Sloman, 2011). Irrespective of whether the approach should be role playing or theatre, it is agreed that the portrayed skit mirrors aspects of the real world. Thus the participants have a felt understanding of the issue being portrayed. The benefits of using skits are that they promote dialogue, since the community members identify and analyse the issues, they create an opportunity for learning and awareness raising, and help participants consider the idea from different perspectives and to think of appropriate solutions, thus stimulating social and behaviour change (Mbachaga, 2010; Cohen *et al.*, 2011:510-513; Sloman, 2011). The choice of a skit was deemed appropriate for the context as well as the topic. Being an urban area, there was a need to use alternative approaches (as opposed to indigenous approaches that work best in rural areas) that would create an enabling environment for the participants to talk openly about their sanitation experiences and concerns.

The interviews that had been conducted in the previous stage led to a better understanding of decision making at the household level, information that helped to design the storyline of the skits, which were modified according to the type of participants. An example of the storyline for the skit played out for tenants living in compounds with landlords but without sanitation facilities is detailed in Box 1.

After the skit, the participants formed smaller groups for the sake of having a focused discussion. There are variations in the number of participants required for a focus group discussion, with numbers ranging from a minimum of three participants to a maximum of 12 (Barbour, 2010:60; Nieuwenhuis, 2010a:91; Cohen *et al.*, 2011:437; Kumar, 2011:128; Neuman, 2011:459; Daniel, 2012:243; Green & Thorogood, 2014:130). The smaller focus groups had a minimum of four and a maximum of six members. The participants were divided into smaller groups to ensure interaction, without dominant voices silencing others (Nieuwenhuis, 2010a:91; Cohen *et al.*, 2011:436-437). FGDs as data collection methods are important because they yield information on complex issues that may require discussion for a better understanding, they may be used to extend or clarify data collected through other methods such as interviews, and they encourage interactions among interviewees, which usually yields more information (Gill, Stewart, Treasure & Chadwick, 2008; Reed *et al.*, 2009; Cohen *et al.*, 2011:436; Creswell, 2012). They can also be used to counter the disadvantages of interviews, and they provide a platform for the discussion of sensitive issues that can be discussed easily within groups (Green & Thorogood, 2014:133). Each of the groups had a moderator and an assistant who captured the discussion using an audio recorder. The moderator used a guide that had questions related to decision making as pertains to shared sanitation facilities, as well as the sanitation technologies that they preferred or thought were appropriate for their settlements. The guide is attached as Appendix 6.

After the small group discussions, all the participants converged again for a common discussion, which ended with participants arriving at a consensus on what they deemed were the most appropriate sanitation technologies for their settlements.

Box 3.1: A synopsis of a skit used in one of the focus group discussions

Category of FGD participants: Tenants from compounds with resident landlords, but without sanitation facilities

Scene 1:
A man (Baba Lupita) rushes into his house, calling out for his wife (Mama Lupita), while holding his abdomen. He seems to be in pain, but his wife is taking too long to respond to his call. When she finally shows up, he questions why she took long, and she responds that she was cleaning utensils. He begins explaining that his stomach is messed up, but as he does this, Mama Lupita covers her nose due to the awful smell caused by her husband's fart. He asks her to bring him some toilet paper. She questions why he should ask for toilet paper, since they did not have any. He responds that he brought some from their neighbour. She does not believe him, and therefore takes it that he is asking for toilet paper because they have guests (who in this case are the FGD participants) and he would like to show off that they are 'wealthy'. Since he desperately needs toilet paper, he begs her to save him the embarrassment and get some toilet paper, or 'anything' else that he can use. Seeing that it is a desperate call, she offers to run to their neighbour to ask for toilet paper for her beloved husband, while he eagerly waits for her to return. Mama Lupita comes back shortly with some toilet paper, and informs her husband that she has done the best she could, and so he would have to 'sort himself out' (she leaves the stage).

Scene 2:
In 'sorting' himself out, he sneaks into his neighbour's compound with the intention of using her toilet, but the owner finds him just as he is about to let himself into the toilet. He tries to explain that he had the intention of asking for her permission to use her toilet. She does not believe him, and she asks (in a confirming way) whether Baba Lupita's landlord lives within the compound. Baba Lupita seems to be in need of a toilet desperately, but she continues hurling insults at him, saying that they (he and other tenants from his compound) are the reason why her toilet is in a deplorable state. She continues to lament that she has used all her financial resources to construct the toilet, and for that reason she and her children do not have sufficient food (to the extent that she has lost weight). Her efforts to lock the toilet have been unfruitful because for the last three years, tenants from Baba Lupita's compound have been sneaking in and using her toilet. They have not invested in a toilet and thus, unlike her, they have more than enough resources for food and are consequently gaining weight by the day. Baba Lupita eventually gathers courage and (as though the pain has disappeared) comments that due to her insults, he has lost the urge to use the toilet. She eventually allows him to use the toilet once more, but assures him that she is on her way to purchase a better padlock for locking her toilet (she leaves the stage).

Scene 3:
Baba Lupita is not happy with the insults he received, and ponders loudly why they do not have a toilet in their compound, even though they have a live-in landlord. He asks himself questions about what he can do to save the situation, whom to consult and how they could organise themselves as tenants to construct and clean the toilet. He is in a dilemma over what to do.

Sample size

Just like the number of participants for FGDs, there are variations in the number of FGDs to carry out. Daniel (2012:243), for instance, recommends that three to 12 groups are necessary, Neuman (2011:459) suggests that four to six groups are enough, while Barbour (2010:60) highlights that at least two are enough. She adds, however, that the number of FGDs to conduct is determined by the comparisons that the researcher wishes to make. In this study, the principle of data and theoretical saturation was used to evaluate the number of discussions to be held.

It was felt that new data did not emerge after conducting eight participatory group discussions, from which twenty-one focus group discussions were conducted.

Stage three: Policy-level decision-making workshops with stakeholders involved in sanitation in the informal settlements

This stage involved holding workshops with stakeholders involved in sanitation in order to make decisions on sanitation. Respondents were selected using the snowball sampling method, in which a small number of individuals with the characteristic of interest are identified, and these individuals then identify others who also have the same characteristic (Cohen *et al.*, 2011:158-159; Kumar, 2011:208). This sampling method is said to be valuable in qualitative research (Cohen *et al.*, 2011:159) and is useful for studying topics such as decision making or diffusion of knowledge (Kumar, 2011:208). Details about the stakeholders, how they were selected, and how the workshops were conducted are provided in Chapter 7. In total, two stakeholder workshops, one with a total of 53 and the other with 90 participants, were held.

3.6 Ethical consideration and procedures

The study was approved by the Research Ethics Committee (REC) of Stellenbosch University. A research permit was granted by the Kenya National Commission for Science, Technology and Innovation (NACOSTI) (Permit number NACOSTI/P/14/5546/781). In Kisumu, a clearance letter was obtained from the Kisumu County Education office and permission was granted by the chiefs within the settlements. In every compound permission was sought from the landlord or caretaker (if available). The aims and objectives of the study were clearly spelled out to all the respondents, detailing what would be required of them and giving them an opportunity to consent to participate in the study. Consent to inspect the sanitation facilities was also given by the respondents (Appendix 1). To ensure anonymity and confidentiality, a study code was used that ensured that respondents would not be linked to the information they provided. No names or personal information was

recorded on the data collection tools. Data were not shared with unauthorised persons who were not part of the study.

3.7 Data management

After verification, the quantitative data were entered into Epi-Info. The check code editor in Epi-Info was used to control data entry, ensuring that all data were entered correctly and none were missing. Audio-recorded qualitative data were stored in computers, as well as in the audio recorders. This data were then transcribed in Microsoft Word and later transferred to ATLAS.ti software for management and further analysis.

3.8 Data analysis procedures

The distribution of continuous variables was checked using histograms before any analysis was done. Variables were summarised through frequencies to confirm if there were any irregularities or missing data. The analysis was done by both descriptive and inferential statistics. The specific details of the quantitative data analysis are described in Chapters 4 through 6.

Qualitative data analysis was an iterative process that began with the first round of data collection, continuing throughout the data collection process. Starting with the analysis early allows the identification of relevant concepts, follow-up on subsequent questions, the development of theories, and gives an indication of areas that need keen listening and observation (Stewart, Shamdasani & Rook, 2007:113; Corbin & Strauss, 2008:57; Nieuwenhuis, 2010b:100; Cohen *et al.*, 2011:539). During the data collection process, events and happenings, emergent issues, cases that were out of the norm and issues that needed to be investigated further were noted on a daily basis. Other analytical tools, such as listening to the respondents' emotions during the interviews, paying attention to the interaction of participants during the group discussions, and listening to the language used (as pertains sanitation) were also used during data collection and analysis (Corbin & Strauss, 2008:69; Liamputtong, 2011:177-178). An in-depth explanation of qualitative data analysis is provided in Chapters 6 and 7.

3.9 Quality assurance

Reliability, replicability and validity are by and large viewed as measures of quality in research. Reliability describes dependability and consistency over time – a demonstration that if the research was to be carried out on similar respondents and in similar contexts the results would be similar (Cohen *et al.*, 2011:199). Replicability

describes the ability of the tests to be repeated, and validity defines whether the results are an accurate representation of the features that were meant to be measured (Cohen *et al.*, 2011:179; Bryman, 2012:46-48).

Quality qualitative research should resonate with the readers' and participants' life experiences, should be clear, logical, have substance, give insight, and stimulate discussion and further research on a topic (Corbin & Strauss, 2008:302). Valid and reliable qualitative research is credible and trustworthy (Nieuwenhuis, 2010a:80), and it can be achieved by using multiple methods of data collection as well as triangulation (Flick, 2008:40-41,95-96; Silverman, 2010:277). Replication in qualitative studies is rare, however, because of changing human nature (Maree & Westhuizen, 2010:37; Bryman, 2012:47).

The following measures were taken to ensure that the quality of the data was not compromised:

- Research assistants were recruited only if they lived in Kisumu and could communicate in the local language.
- The assistants were trained before each phase of data collection. They were enlightened on aspects such as the objectives of the research, administration of data collection tools, handling respondents, ethics of data collection, and skills needed during data collection. The training was done to ensure that they understood the data collection procedures as well as the questions in the tools.
- During training, role playing of hypothetical challenges during data collection was used, and ways of overcoming any emanating challenges were proposed. In this way, the assistants were equipped with skills to handle the different types of respondents that they would encounter in the settlements during data collection.
- All tools were pre-tested and any anomalies and irrelevant, missing or unclear questions were corrected before actual data collection.
- The questions in the tools were translated into Swahili and the local language, and revised after the pre-test so that there was uniformity in asking the questions.
- Standard operating procedures were developed, to which all research assistants adhered.

- The research assistants worked in pairs, which enabled one person to guide the interview while the other completed the tool, audio recorded the interview and noted the observables (including the respondents' body language). During sanitation inspection, one person inspected the sanitation facility while the other one took photographs.
- At the end of each interview, the assistants checked through and verified the responses to ensure that every question was completed. They also repeated the same at the end of each working day.
- Completed tools were verified twice, once by the other group of research assistants and once by the main researcher.
- The same research assistants were engaged in all stages of the study, which minimised errors that might arise from new assistants who did not understand the scope of the study.
- The study used various quantitative and qualitative methods, with results in one method confirming or being confirmed by results from another method. Being an explanatory sequential design, deficiencies from one phase led to the next phase, which also explained the previous phase's findings.

3.10 Challenges and lessons learnt

Lack of data: There generally was a lack of data such as the number of compounds in the settlements, which was especially important in defining the sampling frame. To overcome this challenge, the sample size was divided equally among the four settlements. There also was little documented information on clusters within the informal settlements, as well as unreliable data from sources such as Google Maps due to the ever-growing nature of the settlements. Collaborating with development partners and community leaders, as well as carrying out a preliminary study, was useful in pointing out the clusters and possible alternatives to sampling.

During the survey it was realised that some respondents had the tendency to give socially desirable responses, especially about the availability or lack of sanitation facilities. For example, some respondents mentioned that they lacked sanitation facilities, when in actual fact they had sanitation facilities, even though they were filled-up pit latrines. On other occasions, respondents mentioned that they had sanitation facilities because they feared being arrested. Fortunately, the tool had counter-questions (on inspecting the available sanitation facilities) and it was possible to counter-check the responses given. Constant communication during the data collection process and comparing notes at the end of each working day helped

to keep track of such changes. These limitations were the impetus for subsequent qualitative studies.

Although most residents were generally receptive and participated willingly in the research, there were some residents who were highly suspicious and a few others who demanded a detailed explanation of the research procedures. These residents' questions and concerns were addressed adequately, after which they were willing to participate, but if they were still not willing to be part of the research, the assistants continued to the next compounds/respondents. In total, four refusals were encountered (two in Obunga, one in Nyalenda A, and another in Nyalenda B)

Other residents expressed high expectations from the research, including hopes for the construction of sanitation facilities. To deal with this challenge, it was made clear during the introduction and concluding remarks of the interviews that there was no direct benefit to the respondents, but that the results would be shared with the necessary stakeholders.

Other research participants expected monetary gains from the research, especially during the selection of participants for participatory workshops. Nonetheless, it was made explicitly clear during selection that participation was to be voluntary. More participants therefore were selected to cater for those who would not turn up.

There had been reports of insecurity in the settlements especially during the night. Therefore, as a precautionary measure, data collection was only carried out during the day time. To further ensure safety, there was always a male person with every team of research assistants, either a gatekeeper or a research assistant, who provided some safety for the female researchers.

Some lessons learnt during the fieldwork are:

Informal settlements are ever-expanding and dynamic settlements, and often it may not be possible to have documented literature. Thus local knowledge and pilot studies are very crucial when designing a study.

There are various categories of residents in informal settlements, some of whom are genuinely poor and others who are better off. It therefore is important that researchers take note of such differences and incorporate all the categories of residents. Each of them has different (yet very important) needs and opinions, including information pertaining to sanitation.

Sanitation behaviour and practices in informal settlements are a sensitive topic and people will more often than not give socially desirable responses in order to fit the societal norm. Therefore it is important to use appropriate methods that will make respondents give truthful answers without feeling embarrassed. In addition, it is beneficial to use strategies that will create trust among the residents, for example being part of their daily lives and learning the local language. Researchers may at times need to pause in order to reflect and strategize on the best approaches/methods that will lead to quality data.

It is important to always use gatekeepers when moving around in the settlements. Gatekeepers provide safety to researchers, especially if they are new to the area. In addition, there is need to be gender sensitive, by ensuring that there are male gatekeepers for added 'security', especially to female researchers (if it is culturally/societally acceptable within the area).

It is also important that researchers study and understand the residents in their study area, especially during activities such as participatory discussions. Some residents may ask for monetary gains but they may not turn up for meetings. Such residents are clearly not concerned about the conditions in their settlements. The most valuable and genuine participants, especially in sanitation research, are those who attend meetings without asking for monetary gain. Such residents are genuinely concerned about sanitation conditions in their settlements and are more active in improvement efforts. I need to mention, however, that all participants of group discussions were compensated for their time and participation after the discussions.

Having provided the methods used for data collection, the next four chapters will present the results that answer each of the four objectives that were spelled out in Chapter 1.

CHAPTER 4: LIVING CONDITIONS IN THE INFORMAL SETTLEMENTS OF KISUMU, KENYA[10]

4.1 Abstract

Informal settlements are faced with developmental challenges such as insecure land tenure and a lack of basic services. Each informal settlement however, has unique living conditions which should determine improvement efforts. Using a cross sectional survey, this study aimed at describing living conditions in Kisumu's informal settlements; and proposing areas that require improvement. Results show that the settlements have income generating opportunities; with landlords having some tenure security. However, the settlements are characterised by income poverty, poor housing and lack of infrastructural services such as sanitation. This study adds to the discourse on development in informal settlements by highlighting that tenure security does not always lead to improvement and thus, there is a need for infrastructural service provision, upgrading of housing and supporting existing income generating opportunities within the settlements. Development efforts need to involve everyone including landlords, tenants, community groups, governmental, and non-governmental stakeholders.

Keywords:

Kisumu; Housing; Infrastructure; Landlord; Poverty; Development

[10] An earlier version of this paper was presented at the Social Science and Development (SSD) conference in Stellenbosch, 7-11 September, 2015; and a revised version has been submitted to *Development Southern Africa* Journal.

4.2 Introduction

Informal settlements, slums, shacks, shanties, squatter or illegal settlements, are common in developing countries. The growth of these settlements has been attributed to population growth in urban areas, colonialism and poor urban planning approaches, poor governance, and the inability of governments to meet the demands of the growing urban population (UN-Habitat, 2003a; Cranby, 2012; Fox, 2014a; Huchzermeyer, 2014; Watson, 2014). These informal settlements are characterised by tenure insecurity, informal housing, a lack of basic services, and overcrowding (UN-Habitat, 2003a, 2014:31; Davis, 2006; Nuissl & Heinrichs, 2013). Although these negative characteristics are common defining features, the settlements play an important role as they provide shelter to a large portion of the urban poor (Gulyani & Talukdar, 2008; Roy *et al.*, 2014; UN-Habitat, 2014:43), approximately a third of a city's population (Satterthwaite & Mitlin, 2014:4). In Africa, approximately 62-70% of the urban population lives in informal settlements (UN-Habitat, 2013:151; Turok, 2014; Zhang, 2016). These settlements, therefore, present a unique cultural, economic and political context (Allen *et al.*, 2015) and may have opportunities for improvement and development.

Various approaches have been proposed for improvement of conditions in informal settlements. Conventional development approaches were through clearance and eviction. Such evictions were usually informed by the policymakers' need to plan cities, and at other times, due to the vulnerability of informal settlements to environmental disasters (Navarro, 2014). However, eviction only worsens the problem because the displaced people move to other areas where they still erect informal housing (Woldeamanuel & Palma, 2015).

Therefore, alternative approaches to improving conditions in informal settlements have been suggested. One school of thought proposes that instead of eviction, focussing on tenure security provides residents of informal settlements with a perceived security that allows them to invest in and acquire other services (Jain *et al.*, 2015; Muchadenyika, 2015). Other writers propose in-situ improvement/upgrading of housing in informal settlements because it is cheaper and residents still maintain their existing social and economic networks (Patel *et al.*, 2011; Andersen, 2014; Gilbert, 2014). At a macro-level, it is shown that investment in infrastructure has social benefits such as increased market access as well as better education and health (Estache & Wodon, 2014:16). The provision of basic infrastructural services leads to a general improvement in the well-being of residents

and their living conditions, overall prosperity and sustainable urbanisation in cities (Turok & Borel-Saladin, 2014; Parikh *et al.*, 2015).

In spite of these alternative proposals for development, each settlement has a unique socio-economic context and there is a need to first understand informal settlements in their local conditions (Olthuis *et al.*, 2015) in order to identify key avenues for interventions and improvement. In this regard, Gulyani and Basset (2010) propose that focusing on the physical characteristics of settlements leads to an understanding of areas of lack and unacceptable living conditions, which then aids in developing context-specific interventions by which living conditions can be improved. Living conditions can thus be examined in four areas: tenure, infrastructure, housing quality, and neighbourhood location (Gulyani & Bassett, 2010).

These four proposed themes generally represent the common challenges facing informal settlements in most countries, such as tenure insecurity, poor housing, lack of basic services, and overcrowding. The themes could, therefore, be used as a guide to understanding living conditions and to propose areas of improvement in informal settlements which are expanding not only in capital cities, but in secondary cities such as Kisumu city in Kenya. The aim of this study, therefore, was to describe living conditions in Kisumu's informal settlements by focussing on tenure, infrastructure, housing, and neighbourhood conditions; with a view to identifying key areas that require improvement and further research. The next section of this paper will briefly describe the study area, methods used for data collection, and analysis. Presentation of results, a discussion, and a conclusion will then follow.

4.3 Study area

It is estimated that Kisumu's informal settlements host approximately 60% of the city's population (Syrjänen, 2008). More details about these settlements have been highlighted in section 3.3.

Much of the land in these settlements is freehold land whose owners obtained through inheritance (UN-Habitat, 2005; Huchzermeyer, 2009). Over time, some owners have constructed rental housing, while others have moved to other areas. Consequently, there are resident landlords who live within their premises as well as absentee landlords who do not live within their premises. Housing structures are either constructed in the traditional style, with mud walls and iron sheet roofing or in more modern styles (UN-Habitat, 2005) that include storey buildings with walls of

brick/concrete. These houses are in plots/compounds, with a compound comprising several families under a landlord who would normally be responsible for the provision of services. Many compounds however, lack electricity, water and sanitation facilities (Karanja, 2010).

A number of stakeholders work in the settlements – governmental organisations, NGOs, CBOs, and community groups (UN-Habitat, 2005; Huchzermeyer, 2009; Cage, 2014; Letema *et al.*, 2014).

4.4 Methods

Details about sampling, sampling procedures and data collection methods have been presented in section 3.5.1.

4.4.1 Data collection tools

A structured interview guide with closed-ended questions that were divided into five themes, with each theme defined by a number of variables (Table 4.1) was designed. Face-to-face interviews were conducted with the respondents and their responses were recorded on the interview guide.

Table 4.1: Themes and variables defining living conditions in structured interview guide

Theme	**Measurement variables**
Household characteristics	Age, education, gender, marital status, religion, occupation, spouse's occupation, workplaces, household size, monthly income
Housing unit characteristics	Duration of stay, number of rooms, electricity connection, electricity price, roofing, wall and floor materials, reason for choice of the house
Compound characteristics	Total number of households, main water source, time to main water source, cost of water, second water source, time to second water source, sanitation, waste disposal, security measures, type of residence
Neighbourhood	Available markets, time to markets, time to the link road and the main road[11], time to city centre, time to health centre, schools, form of transport used
General	Main challenges faced

[11] A link road is an earthen road that provides accessibility within the settlements, while the main road is a paved road often providing access to other areas outside the settlement. A link road would be used within the settlement, but a main road would have transportation services and would be used when travelling out of the settlements to other areas.

4.4.2 Data analysis

Data were entered into Epi-Info, checked for errors and transferred to Stata (v13) for analysis. Descriptive statistics were used to summarise continuous variables, and chi-square tests were used to assess relationships/associations among categorical variables

4.5 Results

4.5.1 Household conditions

Most of the respondents (82%) were women who were on average 30 years old. The majority of the respondents were married (71%). Over half of the respondents (54%) had basic education, and were either engaged in some occupational activity or were housewives (36%). On average, the household size was four individuals and the monthly household income was KES 10 588[12].

4.5.2 Housing unit conditions

Most (77%) of the housing units were one roomed. They all had iron sheet roofs, with the greater percentage having plastered walls (57%), cemented floors (71%) and without an electricity connection (57%). The average rent was KES 1 211. The respondents chose to live in the settlements mainly because houses were affordable (34%) or because they lacked other alternatives (24%). Bandani residents paid the lowest mean rent (KES 931), while those in Nyalenda B paid the highest mean rent (KES 1356). Obunga was better served with electricity compared to all other settlements, while Bandani was least served (Chi^2 35.29; $p < 0.001$). Houses constructed with low-quality materials fetched lower rents compared to houses constructed with better materials. For example, for 92% of all housing units with earthen floors and 85% with earthen walls the rent was between KES 300 and KES 1 000. The household and housing unit themes characteristics are summarised in Table 4.2.

4.5.3 Compound conditions and services

The residents lived in compounds that had an average of seven households/families. Approximately only 8% of the compounds had water connections, and households in the rest of the compounds depended on nearby water sources, to which they mostly walked for less than five minutes, paying an average of KES 3 for a twenty litre jerry can.

[12] As at the time of writing, 1USD = KES 100

Table 4.2: Household and housing unit characteristics of respondents in Kisumu's informal settlements (n = 180 unless stated otherwise)

	Mean (range) /Freq (%)		**Mean (range) /Freq (%)**
1. Household		2. Housing unit	
Age	30.36 (18-65)	*Electricity*	
		Connected	78 (43.2)
HH size	3.88 (1-9)	Not connected	102 (56.7)
Gender		*Wall*	
Male	33 (18.3)	Mud	62 (34.4)
Female	147 (81.7)	Iron sheet	16 (8.9)
		Plastering/Rough cast	102 (56.7)
Education			
None	61 (33.9)		
Primary education	97 (53.9)	*Floor*	
Secondary education and above	22 (12.2)	Mud	52 (28.9)
		Cemented/concrete	128 (71.1)
Marital status		*No of rooms*	
Single/unmarried/single parent	24 (13.3)	1	139 (77.2)
		2	34 (8.9)
Married	128 (71.1)	3	7 (3.9)
Widowed/divorced/separated	28 (15.6)		
		Length of stay (yrs)	4.5 (0.06-36)
Occupation			
None/housewife	65 (36.1)	*Rent*	KES 1211.7 (300-3500)
Casual worker	33 (18.3)		
Self-employed/business	76 (42.2)	*House attraction factors*	
Formal employment	6 (3.3)		
		None	43 (23.9)
Spouse occupation (n = 128)		Cost related	61 (33.9)
None/housewife	12 (9.4)	Housing related	38 (21.1)
Casual worker	49 (38.3)	Compound factors	29 (16.1)
Self-employed/business	46 (35.9)	Neighbourhood factors	9 (5)
Formal employment	21 (16.4)		
Monthly household income	10588.76 (0-90000)		
		Area	
Areas of occupation (n = 115)		Bandani	40 (22.2)
In the neighbourhood	71 (61.7)	Nyalenda A	47 (26.1)
Within the city	41 (35.6)	Nyalenda B	50 (27.8)
Outside the city	3 (2.7)	Obunga	43 (23.9)
Spouse's workplace (n = 116)			
In the neighbourhood	21 (18.1)		
Within the city	89 (76.7)		
Outside the city	6 (5.2)		

Seventy-three percent of the respondents mentioned that their main water sources were not reliable, thus they depended on other alternatives, such as springs and boreholes. Sanitation facilities, which were all pit latrines, were shared by the households in the compound, and approximately 64% of compounds had a designated area for solid waste disposal. For security purposes, residents either had a gate, fence, dogs or a combination of several of these. Nyalenda B had a higher

proportion of compounds with live-in landlords, although overall, compounds with absentee landlords were common (53%) in the settlements. There were associations between residence status and services provided at the compound level as well as rent paid. For example, tenants in compounds with a caretaker paid a higher mean rent, of KES 1 487.5, compared to tenants with a live-in landlord and tenants in compounds with an absentee landlord, who paid mean rents of KES 1 205.5 and KES 1 098.4 respectively. Associations between sets of categorical variables and their explanation are summarised in Table 4.3.

Table 4.3: Associations between categorical variables explaining living conditions in Kisumu's informal settlements

Categorical variables	P values	Explanation
Settlement and electricity connection	$Chi^2(3) = 35.29$ $p < 0.001$	Many compounds in Bandani lacked electricity connection, while many compounds in Obunga had electricity connections
Rent (categorised) and having a toilet*	$Chi^2(3) = 22.19$ $p < 0.001$	Respondents from compounds without sanitation facilities paid lower rent
Type of residence and rent paid	$Chi^2(6) = 13.88$ $p = 0.03$	Of tenants paying between KES 800 and 1 000, 61% were from compounds with absentee landlords.
Residence and having a toilet	Chi^2 (2) = 24.89 $p < 0.001$	71% of compounds without sanitation facilities had absentee landlords
Settlement and type of residence	$Chi^2(6) = 18.71$ $p = 0.005$	Most of the compounds in the settlements had absentee landlords, except Nyalenda B, which had more live-in landlords
Residence and electricity connection	$Chi^2 = 8.57$ $p = 0.014$	Most (56%) compounds without electricity connections had absentee landlords
Residence and house floor material	$Chi^2 = 14.47$ $p = 0.001$	Most (67%) of the housing units with mud floors were in compounds with absentee landlords

* For the purposes of cross-tabulation, rent was converted into a categorical variable, with four quartiles of KES 300-800, 801-1 000, 1 001-1 500 and above 1 500.

4.5.4 Neighbourhood conditions

On average, it took 5.7 minutes for respondents to walk to the nearest link road if they lived far from the main road, and an average of 14.5 minutes to walk to the main road. The settlements had markets and/or stalls, from where 96% of the respondents purchased their daily supplies. There were a few schools and health

centres in the settlements, and residents could choose from a variety of transportation modes, such as motorbikes, bicycles and three-wheeler cars. The compound and neighbourhood characteristics are summarised in Table 4.4.

Table 4.4: Compound and neighbourhood characteristics of Kisumu's informal settlements (n = 180 unless stated otherwise)

3. Compound	Mean (range) /Freq (%)	4. Neighbourhood	Mean (range) /Freq (%)
Number of HH	7 (1-25)	Time to link road	5.7 (1-35)
		Time to main road	14.5 (1-60)
Main water source			
Compound connection	14 (7.8)	*Transport to work place*	
Nearby water point	148 (82.2)	*(n = 115)*	
Neighbour's compound	14 (7.8)	Walking	92 (80)
Others	4 (2.2)	Bicycle/motorbike	12 (10.4)
		Three-wheeler cars/minibus	11 (9.6)
Time to walk to water source			
Compound connection	14 (7.8)	*Time to workplace*	15.8 (1-120)
Less than 5 min	111 (61.7)		
5 min and above	55 (30.6)	*Transport to spouse workplace (n = 116)*	
Cost of water at main source	KES 3.2 (1-5)	Walking	52 (44.6)
		Bicycle/motorbike	32 (27.6)
Secondary water sources (n = 132)		Three-wheeler cars/minibus	32 (27.6)
Nearby water point	31 (23.5)	*Transport to city centre*	
Springs and boreholes	79 (59.9)	Walking	50 (27.8)
Stored water	22 (16.7)	Bicycle/motorbike	53 (29.4)
		Three-wheeler cars/minibus	77 (42.8)
Water price at second source			
Stored water	17 (12.9)	*Time taken to city centre*	28.1 (5-120)
No cost	41 (31.1)		
KES 1-3	65 (49.2)	*Transport to health facility*	
Above KES 3	9 (6.8)	Walking	110 (61.1)
		Bicycle/motorbike	35 (19.4)
Residence type		Three-wheeler cars/minibus	35 (19.4)
Live-in landlord	45 (25)		
Tenants with caretaker	40 (22.2)	*Time to health facility*	(0-60)
Tenants only	95 (52.8)		
		Challenges	
Sanitation		Housing unit	42 (23.4)
Available	91 (50.6)	Compound	82 (45.8)
Not available	89 (49.4)	Neighbourhood	55 (30.7)
Waste disposal			
Anywhere in the compound	36 (20)		
Designated area in compound	115 (63.9)		
Outside the compound	18 (10)		
Others	11 (6.1)		
Security			
Some form of security	25 (13.9)		
No security	155 (86.1)		

4.5.5 General findings

Most of the challenges mentioned by the respondents were compound related. For example, residents complained of a lack of sanitation facilities, or of the unhygienic conditions of the sanitation facilities. They also mentioned poor solid waste disposal practices at the compound level. The second most common category of challenges was related to the neighbourhood, mainly insecurity, flooding and general waste management. At the household level, respondents complained of houses that were poorly constructed and that leaked during the rainy season.

4.6 Discussion

This study describes living conditions in Kisumu's informal settlements in four main areas: Neighbourhood conditions, tenure status, housing, and infrastructural provision; with an intent of identifying areas of improvement. Within the neighbourhood, residents of the settlements had access to various transport modes, market services, and some educational institutions. However, insecurity was a major concern, just as it is in other informal settlements in Kenya (Gulyani *et al.*, 2010; Mwangangi & Simiyu, 2014; Beyer *et al.*, 2016). Such insecurity may denote poverty/lack, especially among the uneducated youth who engage in risky activities because of lack of gainful employment. Nonetheless, the array of transportation options, availability of small scale markets and educational institutions is an indication of the possibility of these settlements to be self-sustaining, if development efforts are appropriately implemented. The settlements seem to provide opportunities for income-generating activities, since most residents work within or in close proximity to the settlements, engaging in small-scale businesses and casual work, just as it is with residents in Nairobi's informal settlements (Beyer *et al.*, 2016). The average income in Kisumu's settlements was, however, lower than the income of residents living in informal settlements in Nairobi, where the average income was KES 28 000 (Beyer *et al.*, 2016). The low income is a reflection of income poverty, which is a common phenomenon in most informal settlements (Rakodi, 2014; Sajjad, 2014; Beyer *et al.*, 2016; Manjengwa *et al.*, 2016), since these settlements host most of the urban poor. Kisumu's informal settlements reveal the same characteristic of hosting the city's urban poor.

One challenge facing informal settlements is tenure insecurity, hence the suggestion that land formalisation can lead to tenure security (Handzic, 2010). In Kisumu however, landowners have freehold land titles (Huchzermeyer, 2009) suggesting that security of tenure may not be required to improve living conditions in the settlements.

A situational analysis of Kisumu's settlements also alludes to the same by stating that issues of tenure in Kisumu are not 'critical' (UN-Habitat, 2005), implying that some form of tenure security is assured within the settlements. This finding contrasts the popular stance of formalisation as an avenue for improvement, also supported by research from Brazil, India and Nigeria which confirms that land ownership is not a prerequisite for an improvement of living conditions (Handzic, 2010; Agunbiade *et al.*, 2015; Parikh *et al.*, 2015). The alternative suggestion of formalisation argued that land formalisation ensures tenure security with which residents of informal settlements can invest in and acquire other services (Jain *et al.*, 2015; Muchadenyika, 2015). If that were the case, it would be expected that residents in Kisumu's informal settlements have access to services and good quality housing.

Results show that most of the houses were single rooms constructed using various materials. Some houses were of poor quality, also reflected in the concerns raised by respondents. Such poor-quality housing is a common phenomenon in informal settlements in countries such as Tanzania (Cadstedt, 2010), Nigeria (Daniel *et al.*, 2015), and Ghana (Abu-Salia, Osmannu & Ahmed, 2015; Amoako & Frimpong Boamah, 2016). In South Africa, some of the poor housing are shacks which are structures made from iron sheet or wooden planks often constructed in the backyard of the main house (Govender *et al.*, 2011; Narsai *et al.*, 2013; Turok & Borel-Saladin, 2015). Typical in most informal settlements, these poor quality housing structures are occupied by the urban poor who are often renters. In this study, tenants living in poor housing also paid lower rent. The average rent was similar to the amount paid in other settlements in Nairobi (Gulyani & Talukdar, 2008; Chege & Waweru, 2014; Mwangangi & Simiyu, 2014), but slightly higher than that indicated by the UN-HABITAT report on Kisumu's informal settlements (UN-Habitat, 2005), of KES 300 to 800. It is, however, lower than the rent in other contexts, such as the informal settlements of Cape Town, South Africa, where Govender, Barnes & Pieper (2011) noted that the mean rent for shacks was 20 USD. Such rental differences are pointers to the differences in local context and conditions within informal settlements across countries.

In terms of infrastructure/service provision residents were dissatisfied with services at the compound level due to non-provision or inadequate management arrangements for sharing. As noted from the challenges faced by the residents, most of them were related to the compound, such as lack of sanitation and poor solid waste disposal. In the case of sanitation, some compounds lacked sanitation

facilities, and where they were available they were shared, with various complaints about users' cleaning behaviour. Such results are confirmed by studies from other settlements that show a lack of cooperation among users of shared sanitation facilities (Tumwebaze *et al.*, 2013; Addo, 2015; Parikh *et al.*, 2015). For water, although residents had access to water sources within or in close proximity to their compounds, they also relied on other sources such as stored water, springs and boreholes, which studies on the settlements suggest may be contaminated, thus exposing residents to health risks (Dickson *et al.*, 2015; Okotto, Okotto-Okotto, Price, Pedley & Wright, 2015). Sharing services such as water, sanitation and solid waste disposal is a common practice in informal settlements (Cadstedt, 2010; Gulyani *et al.*, 2010; Govender *et al.*, 2011; Ahmad, Choi & Ko, 2013; Addo, 2015), perhaps due to lack of space or limited provision. Since government's provision of basic services in informal settlements is often lacking, tenants often rely on their landlords to provide some of these basic services.

However, other challenges hinder the full provision of infrastructural services. In Kisumu's settlements, landlords were responsible for providing services such as sanitation at the compound level. Results show that compounds with absentee landlords had poor quality housing and lacked some services such as sanitation facilities and electricity. It is possible that some of these landlords were negligent, reluctant, or they concentrated on other investments that fetch income (e.g. construction of rental housing). Other studies (Huchzermeyer, 2009; Isunju *et al.*, 2011; Ahmad *et al.*, 2013) also show similar results highlighting such practices of absentee landlords. Tenants, on the other hand, opt to live in such compounds probably due to financial limitations. For example, the average rent in this study comprised approximately 11.4% of a household's mean monthly income. Tenants with low incomes therefore may choose to live in compounds with poor-quality housing that lacks basic services so that they can use their low income to meet other needs. It is also possible that the relationship between landlords and tenants is interdependent, just like in Tanzania (Cadstedt, 2010) where both parties can exercise power over each other. The (usually small scale) landlords depend on the rent from the houses as their income, while the tenants can delay payment or refuse to pay due to low or irregular income, or due to non-provision of services. How the two parties resolve these differences depends on the relationship they have. Low education levels may also play a role in influencing decisions that tenants make about the type of housing they occupy.

Having described the living conditions, it is imperative to identify areas that need improvement. A number of approaches have been proposed for improvement, such as tenure security, upgrading of housing and provision of infrastructure. The results of the present study not only reveal income poverty, but also poverty manifesting as the lack of basic services (Gulyani *et al.*, 2014; Satterthwaite, 2014). Such lack thus points to the need for improvement in service delivery especially at the compound level. What has emerged from the results is that even with tenure security, there is still a lack of infrastructural services. Development approaches should be geared towards providing services that are lacking or effective management strategies of services that are shared. Such services and infrastructure include sanitation and solid waste management. Other studies have also alluded to the critical importance of service provision/improvement. In South Africa, Narsai *et al.* (2013) have highlighted the importance of water and sanitation provision, especially in overall health and development, while in India, Jain *et al.* (2015) suggested the delivery of "essential services" for the urban poor, and Parikh *et al.* (2015) showed the importance of water, sanitation and electricity as avenues for improvement of living conditions. Speer (2016) draws attention to the need for and importance of sanitation service provision among homeless people in California, and in Brazil, residents of East District ranked sanitation and sewers, as the second most important area that required improvement (Pimentel Walker, 2016). These studies highlight the importance of and need for infrastructural services especially among the urban poor. Investing in infrastructure is therefore crucial. It is for instance shown that investing in water and sanitation also leads to an improvement in the health and education sectors (Estache & Wodon, 2014:13-14,21); and according to the WHO, for every one USD invested in sanitation, there is a global economic return of five USD (WHO, 2012). Therefore, improvement in infrastructure provision in Kisumu's informal settlements may also benefit other areas such as education, health and overall development.

Alongside service delivery, results point to the need to improve housing, especially those that are in poor condition. Since Kisumu city has a large portion of its residents living in informal settlements, incremental upgrading of housing may be a better alternative. Such kind of upgrading is favoured as residents maintain their social and economic networks (Patel *et al.*, 2011; Andersen, 2014; Gilbert, 2014). Provision of decent housing not only offers privacy and self-respect, but also helps people to be more productive (Turok, 2016). An upgrading of housing may result in slightly

higher rent, hence requiring the involvement of financing mechanisms that include the landlords and tenants. Some sources of finance may even be obtained within the settlements. It was for instance noted that residents were involved in income generating activities within the settlements. This involvement points to the potential that lies within the settlements, and therefore the need to harness such potential. It is noted that informal settlements may be endowed with various forms of capital such as human capital, financial capital, social capital and physical capital, and such opportunities can be utilised by involving local residents in interventions (Abu-Salia *et al.*, 2015).

In view of these proposals for improvement, attention ought to be given to details during the planning and implementation stages, and all stakeholders ought to be engaged (Khan & Wallis, 2015; Muchadenyika, 2015). Evidently, improvement of conditions in the settlements should involve a number of stakeholders, some of whom are presently involved in development work in the settlements. These stakeholders include government ministries, specifically the ministry of land, housing and urban development which is in charge of physical planning and developing housing policies. The ministry of environment and natural resources, together with the National Environment Management Authority (NEMA) would be responsible for policy formulation and developing guidelines on solid waste management. The policies should ensure the provision of basic services at the compound level. NGOs may also be involved in service delivery, supporting demonstration projects for instance in sanitation technologies, providing technical assistance, partnering with governments and working with the urban poor households. CBOs can act as lobby agents and link persons between the community and government/municipality. Finally, landlords play a crucial role in service delivery, while tenants – as recipients – need to be enlightened about their rights to basic services while also taking part in improvement efforts. This involvement should include defining the responsibilities of each stakeholder, their level of jurisdiction and avenues of collaboration. The landlords for instance, since they own land, should be required to construct quality housing and provide services such as sanitation. Where they are unable to, financing mechanisms can be devised through partnership with community based, non-governmental, and governmental organisations. At the neighbourhood level, the county government could collaborate with institutions such as the Water and Sewerage Company, and community groups and associations to increase service delivery and devise mechanisms of ensuring safety within the

settlements. Through the involvement of all these stakeholders from decision-making to the implementation of interventions, improvement efforts will extend beyond compound-level services to the improvement of general living conditions.

4.7 Conclusion

With the increase in the urban population in African cities, so is the growth and expansion of informal settlements. These settlements present different socio-economic and cultural differences, which call for development efforts that are tailored to the specific needs of the settlements. The informal settlements in Kisumu host a large portion of the city's urban population, and an assessment of their living conditions presents challenges as well as opportunities for development. Landlords have some form of tenure security and the settlements show potential for entrepreneurial and income generating activities. Nonetheless, residents, mostly tenants, reveal high levels of income poverty, deprivation in terms of access to infrastructural services and low quality of housing. Tenure security has thus not motivated the landlords to invest in basic services or improve the quality of housing. With such conditions, there is need to improve access to infrastructural service delivery and the quality of housing. This study contributes to the literature on improving conditions in informal settlements by improving access to infrastructural services such as sanitation and energy provision. Improvement efforts should include a variety of stakeholders including residents, governmental organisations, non-governmental organisations and community based organisations from planning through implementation so as to ensure holistic development. The relevant ministries through the local government should collaborate with these stakeholders in policy formulation of service delivery and implementation of these policies.

4.8 Limitations and recommendations

Other variables that describe living conditions, such as healthcare, energy and social networks, were not included in this study. Larger studies can be undertaken for an all-round assessment of living conditions in the settlements. Such studies should assess different facets of poverty in the settlements and avenues through which they can be opportunities for improvement. The studies should consider the settlements as a system, including 'soft' determinants such as beliefs, practices, and relationships, and their influence on development in the settlements.

CHAPTER 5: COST OF AND PAYMENT FOR SANITATION IN THE INFORMAL SETTLEMENTS OF KISUMU, KENYA[13]

5.1 Abstract

Informal settlements are faced with various challenges, such as overcrowding, poverty and a lack of services such as sanitation. These conditions make it difficult to identify an appropriate sanitation technology and to determine the cost of sanitation. In environmental economics, it is possible to estimate the value of goods/services through stated preference or revealed preference methods. In informal settlements however, where tenants may under- or overestimate their willingness and ability to pay for sanitation, revealed preference methods are more reliable in determining the cost of sanitation. This study used the hedonic pricing method to estimate the cost of and willingness to pay for sanitation in the informal settlements of Kisumu, Kenya. A cross sectional study was carried out, and data was collected using a structured interview guide. The data was summarised in percentages and frequencies, and correlation and chi square tests were used to examine associations. Multivariate logistic regression was used to examine the characteristics of individuals with sanitation facilities, after which multiple regression models were applied to identify the determinants of rental prices. Results indicated that tenants who were educated, who paid higher amounts of rent and who lived in compounds with more households were likely to live in compounds with sanitation facilities. The availability of sanitation facilities constituted a substantial amount of rent in the settlements. Landlords as investors could recoup their investment in sanitation if they had more tenants, although tenants were not willing to pay higher rental costs for sanitation facilities shared with many households. It is therefore important to identify an appropriate and affordable sanitation technology, as well as understand the dynamics within informal settlements that influence payment for sanitation.

Key words: *Sanitation, willingness to pay, hedonic pricing, informal settlements, Kisumu*

[13] Part of the results of this paper were presented at the Tropical Institute of Community Health and Development conference at the Great Lakes University of Kisumu (29 April to 1 May 2015), and at the SNOWS conference in Kumasi, Ghana (18 to 20 May 2015).

5.2 Introduction

Informal settlements have a number of challenges, including insecure land tenure, poverty, overcrowding and a lack of basic services and infrastructure (UN-Habitat, 2003a, 2014:31; Davis, 2006; Lüthi *et al.*, 2010; Cranby, 2012; Huchzermeyer, 2014). Sanitation is one of the basic services often lacking in informal settlements, a situation attributed to various factors, including limited public finances at the governmental level (Galli *et al.*, 2014) and a reluctance from local governments to allocate public funds for such private goods as sanitation (McGranahan & Mitlin, 2016). As such, sanitation has been accorded a low priority in terms of financing. In informal settlements where sanitation is lacking, it is important to determine if subsidies are required, the kind of subsidies required, and therefore design appropriate financing and cost recovery strategies (Pieter Van Dijk *et al.*, 2014). Since subsidies may be costly, private/self-financing options are financing alternatives that can be explored (Pieter Van Dijk *et al.*, 2014). Households in informal settlements often provide their own sanitation facilities (Mazeau *et al.*, 2014; O'Keefe, Lüthi, *et al.*, 2015). Such self-provision in poor urban areas often implies that households have to purchase basic services (including sanitation), just like they purchase other commodities (Satterthwaite & Mitlin, 2014:5). It thus becomes imperative to identify who pays for sanitation, how much they pay, what they pay for, and how they pay for it (Isunju *et al.*, 2013), information that is important for overall development of informal settlements.

Drawing from environmental economics, it is possible to estimate the cost of goods and services in a number of ways. One of these ways is through the neoclassical economic approach, through which the cost of goods (and services) can be determined through information given by respondents about their preferences (stated preference), or through observation of behaviour (revealed preference). Stated preference methods have faced several critiques, including challenges of reliability and validity (Venkatachalam, 2004; Alcon & Pedrero, 2010; Loomis, 2011; Brown, 2012; Hausman, 2012; Kling *et al.*, 2012; Whittington & Pagiola, 2012), since they are not based on what people actually do (Fung & Lee, 2014). In addition, due to the hypothetical nature of most willingness to pay studies, it is argued that respondents may be ignorant, uncertain or unable to make a trade-off on the good or service (Kling *et al.*, 2012; Martínez-Espiñeira & Lyssenko, 2012; Mimmi, 2014). Revealed preference methods, however, are based on actual behaviour (Carson & Hanemann, 2005). The Hedonic Pricing Method (HPM), which is a revealed preference approach,

is largely used in the real estate market, and it estimates the willingness to pay for characteristics or services (for instance of a house) as reflected in purchase or rental prices (Brasington & Hite, 2005; Palmquist, 2005; Van Den Berg & Nauges, 2012). Since it is based on actual consumer behaviour, it has the advantage of being able to make use of publicly available data, and it has a clearly defined objective as it analyses effective demand, in comparison to the projected perceptions of demand in stated preference methods (Robbins & Daniels, 2012; Famuyiwa & Babawale, 2014). Since the hedonic pricing method is based on actual behaviour and decisions that people have made rather than assessments of hypothetical alternatives from which their willingness to pay is deduced (Carson & Hanemann, 2005; Boyle, 2012), it is said to have high content validity (Boyle, 2012).

This economic background can be used to estimate the cost of sanitation in informal settlements, but it is important to understand the complexities in informal settlements that affect sanitation provision. Studies from informal settlements in Kenya (Gulyani & Talukdar, 2008), Senegal (Scott *et al.*, 2013), Lesotho and Mozambique (Eales & Schaub-Jones, 2005; Schaub-Jones, 2009), reveal that a majority of residents in informal settlements are tenants. Most tenants are less motivated to invest directly in sanitation facilities, as they consider it the land owner's responsibility (Wegelin-Schuringa & Kodo, 1997; Kulabako *et al.*, 2010). In addition, most tenants may not know the cost of sanitation as noted in Uganda's informal settlements (Ulrich *et al.*, 2016). It is likely, therefore, that tenants may under- or over-estimate the amounts that they are willing and/or able to pay for sanitation through stated preference methods. On the other hand, research (Jenkins & Curtis, 2005; Kulabako *et al.*, 2010) suggests that tenants may pay for sanitation if the costs are indirectly included in their house rental prices. Therefore, in order to determine the cost of sanitation in informal settlements, hedonic pricing method can be used to estimate how much tenants are indirectly paying for sanitation through house rental prices, and how the dynamics in informal settlements influence payment for and provision of sanitation. This study therefore takes on a hedonic approach to estimate the cost of sanitation as revealed through house rental prices in Kisumu's informal settlements. A summary of the hedonic pricing method will be presented, followed by a description of the study area and the methods used for data collection and analysis. This will be followed by the results, a discussion and a conclusion, with the paper providing some policy implications.

5.2.1 The hedonic pricing method (HPM)

The theory behind HPM is that the selling or rental price of a house depends on the buyers' preference for the characteristics of the house. The property is assumed to be sold in a perfectly competitive market and therefore, the buyer determines the price he pays by choosing his preferred attributes (Boyle, 2012; Taylor, 2012).

The price paid for the property is therefore a function of the attributes (Boyle, 2012), and even though consumers pay a bundled price for the house, they are essentially paying for the individual attributes (Flores, 2012). The hedonic pricing method is thus used to evaluate the willingness to pay for these attributes (Brasington & Hite, 2005; Holmes & Adamowicz, 2012; Van Den Berg & Nauges, 2012).

The equation of the hedonic price function is presented as:

$$P_i = f(x_i;\beta) + u_i, \qquad (ii)$$

where

P_i is the selling price,

X_i are attributes of the house (which include characteristics such as number of rooms, and access to neighbourhood services such as schools and workplaces),

β is the vector of coefficients, and

u_i represents the part of the price that is non-explained (Palmquist, 2005; Baranzini *et al.*, 2008).

The relationship described in equation (*ii*), between the price and the attributes, is a linear model, although it can take other forms, such as the semi-log, double log, quadratic, and box cox models (Coulson, 2010; Taylor, 2012; Fung & Lee, 2014). The linear model, just like the normal linear regression model, assumes that the relationship between the dependent variable (house price or rent) and the other independent variables is linear. It is faulted for the assumption it makes that the price of the independent variables is constant, which is not always the case in the real market (Coulson, 2010; Taylor, 2012). In a semi-log model, the independent variables remain untransformed, while the dependent variable takes on the natural log form. A unit change in the independent variable leads to a certain percentage change in the dependent variable. In a double log model, both the dependent and independent variables are transformed to the natural log form, implying that a percentage increase in the dependent variable is due to a percentage increase in the

independent variable. The box-cox transformation model encompasses the three models through a box-cox transformation (Eshet, Baron, Shechter & Ayalon, 2007; Coulson, 2010). It is important that the relationship between the price and the key characteristics of the study are understood (Taylor, 2012) so that the best model is selected, which should be one that gives the best estimates/fit and explanation that is based on the data (Coulson, 2010; Famuyiwa & Babawale, 2014).

5.3 Study area and methods

5.3.1 Study area

Information about the study area has been provided in section 3.3, as well as chapter 4 in general.

In terms of sanitation, the conventional sewer system does not serve the informal settlements; and the most dominant sanitation facilities are traditional pit latrines and a few septic tanks (Letema *et al.*, 2014). It is estimated that half of the compounds in the settlements lack sanitation facilities, with 'flying toilets' being a common practice (Karanja, 2010). This lack of sanitation is worsened by conditions such as high water tables, loose soils and flooding during the rainy season, which has led to the collapse of pit latrines in the settlements (UN-Habitat, 2003b, 2005).

5.3.2 Sample size, sampling procedures and data collection

The sample size, sampling procedures as well as data collection tools have been detailed in section 3.5.1.

5.3.3 Specification of the model used in the study

The dependent variable in this study was the amount of rent paid, while the independent variables were grouped into several categories, these being:

1. Housing unit

   Variables included the duration of stay in a house, number of rooms, floor and wall construction material, and whether the house had an electricity connection.

2. Place

   Place represented each of the informal settlements where the research was carried out.

3. Compound characteristics

Number of houses in a compound, main water sources, travel time to water sources, cost of water, presence of a sanitation facility, waste disposal methods and type of residence (the type of sanitation facility was not included as an explanatory variable)

4. Neighbourhood characteristics

Time taken to access the main road and link road, and forms of transport used to access the central business district (CBD), workplace and nearby health centres.

5. Individual characteristics

Age, education level, occupation, income and household size.

The assumption was that the amount of rent paid is a function of all these variables, thus:

Rent = f (housing unit characteristics, area/location, compound characteristics, neighbourhood characteristics, individual/household characteristics).

5.3.4 Data management and analysis

Data were entered into and cleaned in Epi-Info, before transferring to Stata (v 13) for analysis.

Descriptive statistics were first used to summarise the variables. Histograms were used to assess the distribution of the variables for normality. Continuous variables were summarised through means, standard deviation and frequencies, while categorical variables were summarised through frequencies and percentages.

Pearson's correlation was used to check for linear relationships among pairs of each of the independent continuous variables, and chi square tests were used to assess associations among categorical variables. Multiple logistic regression was further used to assess relationships between availability of sanitation, as the dependent variable, and the other independent variables.

To estimate the effect of the independent variables on rent, multiple regression analysis was performed, in a stepwise manner, using linear, log-linear and double log regression models. Each of these models was assessed for its ability to predict the dependent variable by examining the value of the adjusted R-squared (R^2).

Interaction between explanatory/independent variables was tested using the Wald test. The models were adjusted to account for heteroscedasticity by Huber/White's/ sandwich estimators of robust standard errors, and White's general test for heteroscedasticity was applied. The variance inflation factor (vif) was used to assess for multicollinearity among the independent variables. The model was tested for omitted variable bias using the Ramsey RESET test. All associations were tested at the 95% confidence level.

5.4 Results

5.4.1 Univariate analysis

Most respondents were female (82%), with a mean age of 30 years, and over half (54%) had basic primary education. The respondents and their spouses (where applicable) were mostly self-employed or engaged in casual work, with a mean monthly household income of 10 588 Kenyan Shillings (KES). In terms of housing, most respondents (77%) lived in single-roomed houses, and more than half (57%) of these houses lacked an electricity connection. Sixty-seven percent of the housing units had cemented floors and 57% had plastered walls. The average amount of rent paid per month was KES 1 211.7. At the compound level, the average number of households in a compound was seven, with some compounds having as many as 25 households. Over half of the respondents (53%) lived in compounds with absentee landlords. These descriptive results have been summarised in Tables 4.3 and 4.5.

5.4.2 Multivariate analysis

Results from the Pearson's correlation test showed weak linear relationships between the continuous independent variables. The strongest linear correlation was between age and length of living in a house (r=0.4), as well as time taken to walk to the main road and time taken to walk to the nearest access/link road (0.4). Some associations were noted between categorical variables, and they have been summarised in Table 4.4. Table 5.1 shows more associations between categorical variables that are of interest to sanitation.

In order to understand the individual characteristics of respondents with sanitation facilities, results of the logistic regression indicated that the odds of having a toilet when one was married (compared to being unmarried or a single parent) was 4.6 times greater ($p = 0.008$), and when one had secondary education (compared to not having any education) it was 4.3 times greater ($p = 0.02$). These results are confirmed by cross-tabulation results, which indicate that 70% of the respondents who were single or single parents lived in compounds without sanitation facilities. In addition,

these residents with sanitation facilities also had better services, such as an electricity connection, and better house construction materials for the walls and floors (Table 5.1).

Table 5.1 Tests of associations between categorical variables of respondents in Kisumu's informal settlements.

Categorical variables	P values	Explanation
Chi square test of trend: Availability of sanitation with increasing rent	Chi^2 z = 4.66 P < 0.01	There was an association between having a toilet and paying a higher amount of rent
Electricity connection and availability of sanitation facility	Chi^2 (1) = 14.2933 p < 0.01	Housing units in compounds with electricity connection were also likely to have sanitation facilities
Availability of sanitation facility and the type of wall material used	Chi^2 (2) = 15.8975 p < 0.01	Of respondents with toilets, 71% lived in houses that had rough-cast walls
Floor material and availability of sanitation facility	LR chi^2 (1) = 19.1 p < 0.01	Of residents with toilets, 86% lived in houses with cemented floors
Residence and having a toilet	Chi^2 (2) = 24.89 p < 0.001	Of compounds without sanitation facilities, 71% had absentee landlords

* For the purposes of cross-tabulation, rent was converted into a categorical variable, with four quartiles of KES 300-800, 801-1000, 1001-1500 and above 1500

Table 5.2 shows the results of the multiple logistic regression. The results reveal that, for every one unit (KES per month) increase in rent, the odds of having a toilet increased by 1%, while for every increase in the number of households, the odds of having a toilet increased by 28%. However, the odds of having a toilet reduced by 18% in compounds with absentee landlords compared to compounds with live-in landlords. These results are confirmed by the cross-tabulation results in Table 5.1.

Table 5.3 shows the coefficients, robust standard errors and P-values of variables in the linear, log-linear and double log models. The double log model was adopted, as it gave the best prediction and the highest value of R^2. Variables from the housing unit category of independent variables explained approximately 43% of the variation in rent, compound characteristics explained 4.6%, area (settlement) characteristics explained 3.9%, household characteristics explained approximately 2.7%, and neighbourhood characteristics explained 0.5% of the variation in rent.

In general, from Table 5.3 it is clear that residents living in housing with more than one room, with an electricity connection, and with better walls and floors paid a

higher amount of rent. It is also evident that residents living in Nyalenda B pay more for housing (p=0.004 (CI 0.076 - 0.394)).

Table 5.2: Logistic regression results of characteristics of respondents with sanitation facilities in informal settlements of Kisumu

Variable	Odds ratio	S.E	P-Value
Two-roomed house	0.49	0.38	0.36 (0.11- 2.21)
Three-roomed house	0.51	0.616	0.57 (0 .04- 5.51)
Electricity	2.49	1.655	0.170 (0.67- 9.16)
Rent	1.01	0.001	0.029 (1.000- 1.002)*
Cemented floor	1.10	0.770	0.892 (0.27- 4.34)
Iron sheet wall	0.77	0.785	0.800 (0.105 - 5.66)
Rough cast wall	2.23	1.616	0.264 (0.54 - 9.21)
Nyalenda A	0.33	0.263	0.165 (0.06 - 1.57)
Nyalenda B	0.28	0.202	0.078 (0.06 - 1.15)
Obunga	0.46	0.388	0.358 (0.08 - 2.40)
Number of HH in compound	1.28	0.092	0.000 (1.11 -1.48)*
Waste disposal at a designated area in compound	0.39	0.236	0.122 (0.12 - 1.27)
Waste disposal outside the compound	0.03	0.037	0.001 (0.004 -0.271)*
Some form of security in compound	35.86	46.142	0.005 (2.88 -446.51)*
Tenants in compounds with caretaker	0.61	0.468	0.518 (0.13 - 2.75)
Tenant-only compounds	0.18	0.118	0.008 (0.05 - 0.64)*
Less than five minutes to water source	7.90	9.071	0.072 (0.83 - 74.94)
Over five minutes to water source	6.94	8.248	0.103 (0.67 - 71.29)
Primary education	0.40	0.225	0.105 (0.13 -1.21)
Secondary education	2.32	2.085	0.348 (0.39 -13.49)
Household size	0.87	0.138	0.412 (0.64 - 1.19)
Married respondents	2.35	1.893	0.287 (0.48 -11.39)
Widowed/divorced/separated	2.29	2.320	0.411 (0.31 - 16.64)
Monthly income	0.99	0.0000	0.788 (0.999 -1.00005)
N = 169			
LR chi^2 (24) = 107.62			
P < 0.01			
Pseudo R^2 = 0.46			

***** Significant at the 95% confidence level

At the compound level, residents in compounds with sanitation facilities paid a higher amount of rent. Sanitation constituted 54% ($(e^{.434}-1)100 = 54\%$) of the rent, implying that, on average, it costs households KES 655 every month to live in compounds with sanitation facilities. The results show a negative interaction effect between having a toilet with an increase in the number of households. From the coefficient of the interaction (-0.155), rent reduced by 16% for every integer increase in the number of households sharing toilets.

Table 5.3: Results of the linear, log-linear and double log regression models of determinants of rent prices in informal settlements of Kisumu.

Variable	Log-Log			Log-linear			Linear		
	Co-eff	S.E**	P value (CI)	Co-eff	SE**	P Value (CI)	Co-eff	SE**	P value (CI)
Electricity	0.234	0.066	0.001 (0.103 - 0.365)*	0.209	0.066	0.002 (0.077- 0.341)	325.208	94.767	0.001 (137.94 - 512.47)
Iron sheet wall	0.130	0.105	0.217 (-0.077 - 0.339)	0.176	0.104	0.094 (-0.031 - 0.384)	143.591	115.357	0.215 (-84.35 - 71.538)
Rough-cast wall	0.182	0.075	0.018 (0.032 - 0.332)*	0.233	0.076	0.003 (0.082 - 0.383)	262.763	83.762	0.002 (97.24 - 28.278)
Two-roomed house	0.330	0.076	0.000 (0.179 - 0.481)*	0.305	0.071	0.000 (0.164 - 0.448)	389.89	91.909	0.000 (208.27 - 571.505)
Three-roomed house	0.503	0.130	0.000 (0.246 - 0.761)*	0.503	0.126	0.000 (0.253 - 0.753)	869.301	277.880	0.002 (320.21 -1418.39)
Cemented floor	0.166	0.071	0.021 (.025 - 0.307)*	0.107	0.072	0.14 (-0.035 - 0.251)	102.624	82.720	0.217 (-60.831 - 266.08)
Nyalenda A	0.090	0.077	0.242 (-0.061 - 0.242)	0.103	0.073	0.161 (-0.042 - 0.249)	107.564	89.055	0.229 (-68.410 - 283.54)
Nyalenda B	0.235	0.080	0.004 (0.076 - 0.394)*	0.233	0.073	0.002 (0.088 - 0.378)	210.048	88.291	0.019 (35.583 - 384.51)
Obunga	0.156	0.087	0.074 (-0.015 - 0.328)	0.155	0.084	0.068 (-0.012 - 0.323)	98.996	103.03	0.338 (-104.6 - 302.5)
Toilet	0.434	0.170	0.012 (0.097 - 0.772)*	0.342	0.129	0.009 (0.086 - 0.598)	418.252	172.1	0.016 (78.18 - 758.32)
Compound HH	0.060	0.067	0.368 (-0.072 - 0.193)	0.011	0.014	0.44 (-0.017 - 0.039)	13.761	16.88	0.416 (-19.59 - 47.11)
Toilet#comp hh[a]	-0.155	0.086	0.076 (-0.326 - 0.016)	-0.025	0.015	0.112 (-0.057 - 0.005)	-39.190	19.761	0.049 (-78.24 - -0.141)
Nearby water point	-0.020	0.106	0.851 (-0.231 - 0.190)	-0.020	0.108	0.847 (-0.236 - 0.194)	-65.266	167.13	0.697 (-395.52 - 264.98)
Neighbours water	0.0423	0.134	0.753 (-0.223 - 0.307)	0.015	0.132	0.908 (-0.247 - 0.278)	-9.8276	202.71	0.961 (-410.4 - 90.747)
Others-borehole, springs)	0.190	0.129	0.142 (-0.064 - 0.445)	0.229	0.130	0.081(-0.028 - 0.488)	183.851	187.605	0.329 (-186.86 - 554.56)
Time to main road	-0.027	0.034	0.421 (-0.096 - 0.040)	-0.001	0.002	0.465 (-0.007 - 0.003)	-2.1150	3.4621	0.542 (-8.95 - 4.72)
Primary educ	0.078	0.055	0.163 (-0.032 - 0.188)	0.068	0.052	0.193 (-0.035 - 0.172)	45.081	62.134	0.469 (-77.69 - 167.86)
Secondary educ	0.237	0.093	0.012 (0.052 - 0.42)*	0.211	0.093	0.025 (0.026 - 0.395)	293.16	144.79	0.045 (7.04 - 579.28)
Monthly income	0.024	0.033	0.466 (-0.041 - 0.090)	4.48	2.62	0.089 (-6.86 - 9.66)	.00939	0.003	0.012 (.002 - .016)
N			167			169			169
F statistic			12.69			13.11			10.14
P			0.000			0.000			0.000
R^2			0.551			0.548			0.546

[a] Test of interaction between having a toilet and number of households in a compound

*Significant at the 95% confidence level

**Robust standard errors

Overall, the model gave a mean variance inflation factor of 1.73, thus an indication that the independent variables were not linear combinations of each other. In addition, White's test for heteroscedasticity gave a chi square value of 143.6, with a p-value of 0.49, which led to accepting the null hypothesis that there was equal variation among the independent variables, hence no heteroscedasticity. Figure 5.1 shows the goodness of fit of the model in its prediction of rent. The Ramsey RESET test for omitted variables led to the acceptance of the null hypothesis that the model had no omitted variables (F (3, 144) =1.68, P = 0.17), thus leading to the conclusion that more variables were not needed to predict the dependent variable.

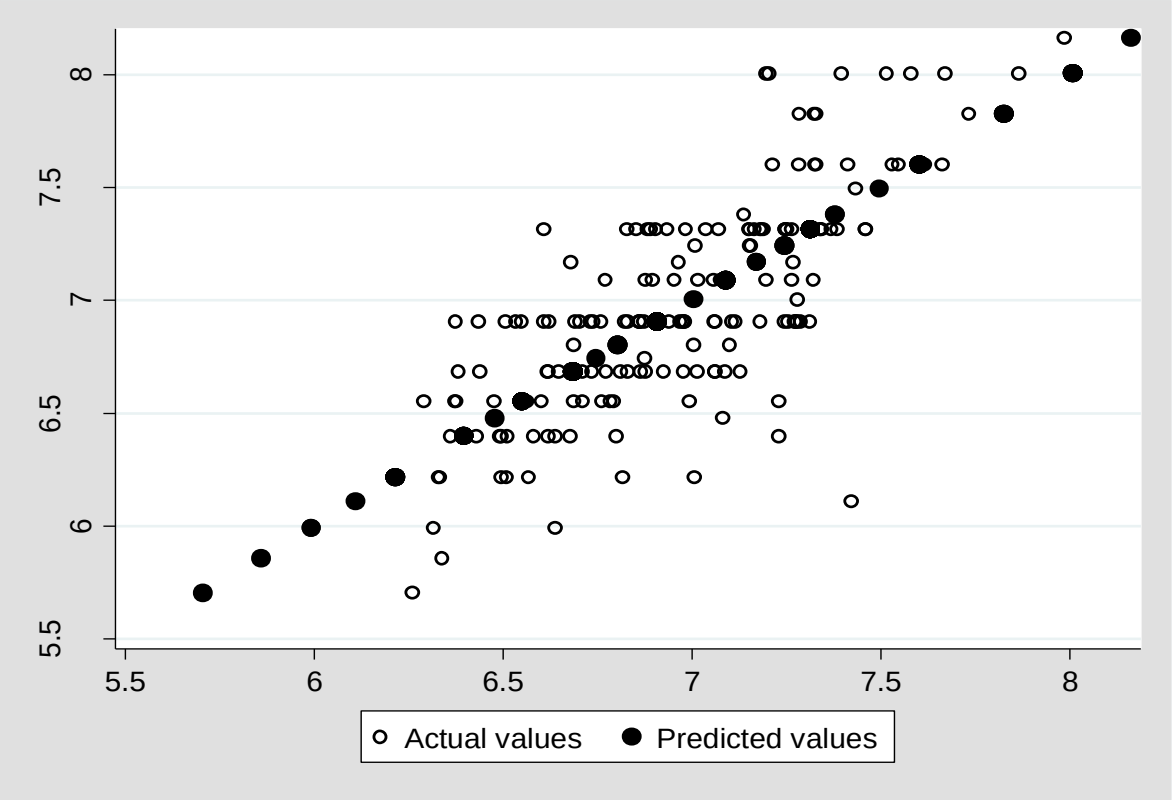

Figure 5.1 Goodness of fit of the log-log model in predicting the dependent variable (log-rent).

Informal interviews with community residents and leaders indicated that, on average, it cost approximately KES 60 000 to construct a simple pit latrine with brick walls, iron sheet roofing and cemented floor slab[14]. A landlord would therefore recoup KES 655 per month for sanitation with one tenant household, and it would take

[14] Chapter 8 has more details on the common construction materials of pit latrines in the settlements, and Appendix 7 has some photos of latrines in the settlements.

approximately 91.6 months to fully recover the investment costs in the sanitation facility. On the other hand, if a landlord had seven tenant household (the average number of households per compound in this study), he would recoup KES 4 585 per month, and it would take him approximately 13 months to recover the amount he invested in sanitation facilities. Figure 5.2 is a projected estimate of the time it would take to recover sanitation investment costs against the number of tenant households in a compound.

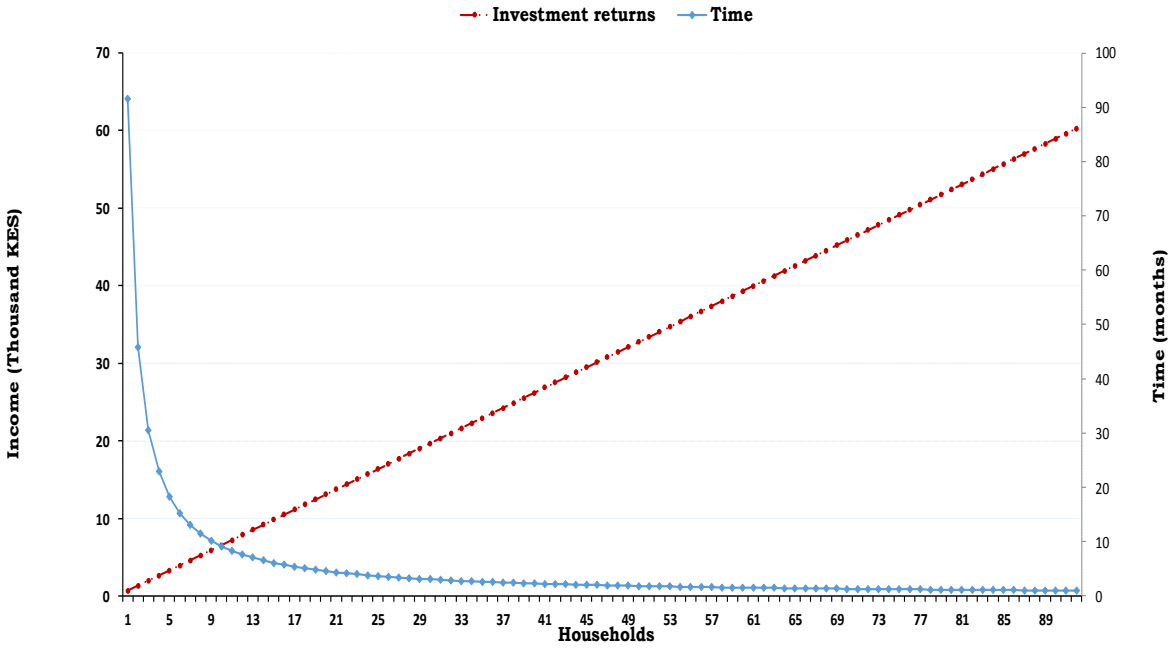

Figure 5.2 Projection of time taken to recover investment in sanitation against number of households[15]

5.5 Discussion

The discussion is divided into two parts; the first section discusses the cost of sanitation as estimated through the HPM in Kisumu's informal settlements, while the second part discusses the economic dynamics of sanitation in these settlements.

5.5.1 Estimating cost of sanitation through the HPM

Knowledge of the cost and value of sanitation is critical, especially in poor urban areas. Studies have used the contingent valuation approach, with very few taking on a hedonic approach to estimate the cost of sanitation in informal settlements. This

[15] These projections are based on a single pit latrine, and they exclude any extra expenses, such as costs of repair and emptying.

study adopted a hedonic approach and compared the linear, semi-linear and double log models to estimate the effect of sanitation on rent. Although the three models gave varying effects of sanitation on rental prices, the values of R^2 from each of the three models were not very different, and the effect of sanitation was significant in all three models (Table 5.3).

The findings further revealed the association between having sanitation facilities and better quality housing, and also that the availability of sanitation facilities constituted a substantial amount of rental prices. These findings concur with those of a study by Gulyani *et al.* (2012), who used a hedonic approach with a log linear model to assess the determinants of rent prices in the informal settlements of Dakar (Senegal) and Nairobi (Kenya). They noted that access to a toilet (shared by 10 households or less) in Nairobi's informal settlements raised the monthly rent by 1.6%. These percentages in Gulyani's study are substantially lower than those in this study, and this may be attributed partly to regional differences. For example, the study by Gulyani *et al.* (2012) included several informal settlements in each of the two cities, which may also have different socio-economic conditions and preferences. Kibera in Nairobi, for instance, has had a number of interventions of communal sanitation facilities, with a study by Schouten and Mathenge (2010) indicating that the residents preferred communal sanitation alternatives. With such preferences, it is likely that their willingness to pay a higher amount of rent for sanitation facilities that are shared by a number of households may be lower.

Other hedonic studies have highlighted increments in rental values due to sanitation, for example an increment of 11.5% to 32% in Bangladesh (Ahmad, 2015b), a 20% increment in Togo (Choumert, Kere, *et al.*, 2014), and a 60% increment in Sri Lanka (Van Den Berg & Nauges, 2012) (summarised in Table 2.2). A few others have highlighted the incremental effect of 'improved' sanitation facilities and technologies. From Indonesia, Brueckner (2013) highlights that housing properties with their own toilets had a rent 14% higher compared to housing structures that lacked sanitation facilities or that had shared sanitation facilities. In Uganda, Knight *et al.* (2004) highlighted that flush toilets increased the rent by 42%, while a pit latrine led to a 26% increase in rent. Similarly, in Nigeria, Ajide and Kareem (2010) report that an improved technology (such as a flush toilet) attracted a higher increase in rent than an unimproved sanitation facility such as a pit latrine or a bucket latrine. The same findings are also expressed by Jenkins *et al.*'s (2014) study in Tanzania, in which it was reported that households with improved sanitation facilities paid higher rents.

Although the type of sanitation technology is an important consideration, this study did not investigate the effect of different sanitation technologies, since all the respondents used pit latrines. The prevalent use of pit latrines is not surprising, since other studies and reports indicate that there are fewer sanitation technologies within Kisumu's informal settlements, and pit latrines are used by the majority, while septic tanks serve a small minority (UN-Habitat, 2005; Letema *et al.*, 2014; Tsinda *et al.*, 2015). This predominance of pit latrines is common in other informal settlements in Uganda (Tumwebaze *et al.*, 2013), Tanzania (Isunju *et al.*, 2013; Pieter Van Dijk *et al.*, 2014), Rwanda (Tsinda *et al.*, 2013), Senegal (Scott *et al.*, 2013) and Ghana (Adubofour *et al.*, 2013). Possible users of the few septic tanks in Kisumu's informal settlements would most likely be home owners, who were purposely left out of this study because they were not rent payers.

5.5.2 Economics of sanitation in the complex dynamics of informal settlements

In order to understand the economic dynamics of sanitation in Kisumu's informal settlements, it is necessary to explore other factors that directly or indirectly influence payment for sanitation. One of these is the characteristics of residents with sanitation facilities. The results of the logistic regression reveal that residents who were likely to have sanitation facilities were those who had secondary education and were married. Education is not only important in urban informal settlements, but in the rural areas too, as confirmed by studies from Tanzania (Sara & Graham, 2014) and India (Shakya, Christakis & Fowler, 2015), which found that educated individuals were more likely to own and use sanitation facilities. Similarly, in Indonesia, it was noted that individuals with higher levels of education were likely to select housing with better characteristics, such as toilets, hence they paid more for rent (Brueckner, 2013). These findings confirm that educated households are knowledgeable about the importance of sanitation, they choose to live in compounds with sanitation facilities, and therefore are willing to pay a higher rent in order to acquire sanitation.

Another important characteristic is income, since it is expected that income determines the purchase of sanitation facilities or the paying of a higher amount of rent (according to neoclassical economics). The results from the logistic and hedonic regression models, however, suggest otherwise. Similar findings are reported from rural Tanzania, where Sara and Graham (2014) found that income was not a significant factor for acquiring and using toilets. With this contrast, it becomes imperative to understand if income is a barrier to or determinant of the acquisition

of sanitation in informal settlements. A study from informal settlements in Kampala, Kisumu and Kigali (Okurut & Charles, 2014) highlighted that 'inability to afford' improved sanitation hindered demand for sanitation in the informal settlements. In contrast, the findings from this study suggest that affordability is just but one determinant. Although high costs can lock out the poor, who may not be able to afford sanitation, there are other factors that also explain payment for and acquisition of sanitation facilities in informal settlements aside from income.

The results of the multivariate logistic regression gave an indication of some of these factors. The results revealed that individuals living in compounds with more people were likely to have toilets, while those in compounds with absentee landlords were less likely to have sanitation facilities. It is within these 'compound' factors that complexities of payment for sanitation within informal settlements are hidden. Some of these complexities can be explained by land tenure factors, which Scott *et al.* (2013) highlight as being crucial because they greatly influence investment in sanitation in informal settlements.

To examine the effect of tenancy, the results indicated that tenants living in compounds with absentee landlords were more likely to pay lower rents. This finding can be linked to the study by Okurut & Charles (2014), who highlighted that the main hindrance to installing sanitation facilities in Kisumu was a lack of space, because most of the available space had been used to construct rental housing units. The explanation for these findings is that landlords, especially absentee landlords, are more likely to focus on constructing housing units (which may not be of good quality because the rents are low) so that they can maximise rental returns. For such landlords, constructing sanitation facilities may be costlier (and without immediate returns) than constructing housing units (which have monthly returns), hence the reason why low-quality housing units often lack sanitation facilities. It therefore becomes crucial to understand the cost of investing in sanitation.

The estimated cost of investment in a single pit latrine found in this study falls within the range of costs quoted in Uganda, of approximately USD 418 to 1 250 (Isunju *et al.*, 2013; Ulrich *et al.*, 2016), but is higher than the range in Tanzania, of approximately USD 200 to 445 (Isunju *et al.*, 2013; Jenkins *et al.*, 2014). The projection in Figure 5.2 suggests that landlords are likely to recover their investment in a shorter time if more households share sanitation facilities. The results also show that compounds with more households were more likely to have sanitation facilities, but the rent decreased with increasing number of households. These results suggest

that landlords, who often times constructed the facilities themselves or hired local community masons who would often times be unskilled (Tsinda *et al.*, 2015; Ulrich *et al.*, 2016) can spread the costs of investment in sanitation among many households, which implies that the cost per household may be substantially lower compared to the cost per household in a compound with fewer households.

Landlords therefore have to make decisions on whether to provide sanitation facilities shared by fewer tenants who pay slightly higher rents, or have more tenants sharing a toilet and paying slightly lower rent. These projections, however, exclude other expenses that a landlord may incur that are common to pit latrines, namely operation and maintenance in the form of emptying and repairs. The frequency of pit latrine emptying is determined by factors such as number of users/loading rate, size of the pit, the type of materials dumped into the pit (materials like plastics and sanitary pads make the pits fill up faster due to the long time it takes for them to decompose) and the level of the water table, especially during rainy/flooding seasons (Isunju *et al.*, 2013; Nakagiri *et al.*, 2015). Depending on these factors, the frequency of emptying varies, with studies indicating that some pits are emptied as often as every one to six months (Isunju *et al.*, 2013; Nakagiri *et al.*, 2015), while others are emptied only after a couple of years (Nakagiri *et al.*, 2016). The cost of emptying varies, with preliminary studies (Simiyu, 2015) and informal interviews showing that households in the settlements prefer manual pit latrine emptiers, who charge a negotiable rate of KES 3 000 to 6 000. A landlord with many household tenants may recoup his investments faster from rent, but some of it may be used for the operation and maintenance of the pit latrines. Similarly, a landlord with fewer tenants may take a longer time to recover his investment, but would also spend less on operation and maintenance[16]. These economic dynamics partly explain why some landlords do not provide sanitation facilities and some are less concerned about operation and maintenance (as will be discussed in Chapter 7). As a result, some tenants used toilets in neighbouring compounds, which then led to high loading rates of the pit latrines. To deal with some of these challenges, some compounds had their toilets locked to keep out members from other compounds (Chapter 6), while some live-in landlords allowed tenants from other compounds to use their toilets, but with additional charges (Chapter 7).

[16] It was not possible to estimate the frequency of emptying because of challenges of recall, and also because some tenant respondents had only lived in their current compounds for a shorter period.

Landlords may also be less motivated to construct sanitation facilities if they have fewer households in a compound because it is easier to have fewer tenants finding alternatives (such as sharing sanitation facilities with their neighbours) rather than a higher number of households. For a landlord, it is a 'safer risk' not to provide sanitation facilities to a smaller number of tenants than to a greater number of tenants. Tenants, on the other hand, can opt to live in compounds without sanitation facilities and with low-quality housing where they pay lower amounts of rent (as discussed in Chapter 4), because they can share sanitation facilities with their neighbours without any (or with minimal) payment, especially if they have good neighbourly relations.

A second (social) explanation for the low rent in compounds with a higher number of households is related to the 'free riding' phenomenon experienced with shared goods. When sanitation facilities are shared by many households, some users may not participate in maintenance practices such as cleaning, or some may not be willing to take responsibility for a shared facility. As a result, shared sanitation facilities may not be maintained as properly as private facilities would, rendering them dirty and unpleasant to use (Chapter 6). Dirty, shared sanitation facilities leads to dissatisfaction among users, as has been reported in informal settlements in Uganda (Tumwebaze *et al.*, 2013) and Rwanda (Tsinda *et al.*, 2013). Tenants would therefore not be willing to pay higher rental values for poor-quality shared sanitation facilities with which they are not satisfied, as was also noted in Bangladesh (Ahmad, 2015b). These findings suggest that tenants in informal settlements prefer private household sanitation facilities, or facilities that are shared by fewer households.

These socio-economic dynamics therefore reveal that there are differences between landlords' and tenants' preferences, thus advancing the theory that tenants have less incentive to invest in sanitation facilities because landlords will harness the benefits through rent increments (Mcgranahan, 2015; McGranahan & Mitlin, 2016). These different preferences have also been reported in studies done in Kampala and Dar es Salaam (Pieter Van Dijk *et al.*, 2014), as well as in Ghana (Adubofour *et al.*, 2013). Tenants may not be willing to invest in sanitation because of their 'temporary' status, and because they feel it is the landlord's responsibility. Landlords, on the other hand, may have reasons to increase rental prices if they provide sanitation facilities. Okurut and Charles's (2014) study further reported that tenants in the informal settlements showed no demand for sanitation (by showing no indication of preference to install a sanitation facility). The reason why preference (or demand for sanitation) seemed to

be low in Okurut and Charles's study is due to the temporary or insecure tenure status of tenants. The findings from the current study point to a different conclusion, namely that there is a demand for sanitation (services and technologies), albeit through higher rental prices. The findings suggest that the residents of Kisumu's informal settlements place importance on sanitation, are willing to pay for it, and some are actually paying for sanitation (ability to pay). In the same manner, Ahmad (2015b) found that urban residents in Bangladesh (irrespective of whether they were tenants, owners or squatters) had a demand for sanitation facilities.

Finally, aside from the socio-economic factors discussed, there may be other factors, such as social and cultural norms, which explain payment for sanitation but which may not be explained by economic models. To illustrate the limitation of economic models, O'Keefe *et al.* (2015) argue that, even though an investment in sanitation or a behaviour change could lead to an improvement, it is not sufficient to assume a perfectly rational assessment in sanitation decision making, since an individual might make contrary decisions because of social and cultural norms. In the same manner, although from a study in rural India, London *et al.* (2014) arrive at a similar conclusion that economic factors are not the sole reasons driving consumer purchase decisions, and that social norms are equally influential. Economic models may be a pointer to the cost of sanitation in informal settlements, but other factors that cannot be measured directly but that play a crucial role in influencing decisions about sanitation, such as social and cultural norms, are equally critical. Such factors may be embedded within the complex social dynamics in the settlements and require the use of multiple research approaches and the involvement of various stakeholders within the settlements (Chapter 7).

5.6 Conclusion

This study has investigated the urban poor's payment for sanitation in the informal settlements of Kisumu, Kenya through their revealed preferences. Using the hedonic pricing method, the findings show that the urban poor are willing to pay for sanitation, but that they are faced with a number of limitations. Payment for sanitation is intertwined in the complex dynamics within informal settlements, and it becomes necessary to understand the 'bigger picture' that influences such payment. This study has highlighted that factors influencing payment for sanitation are related to individual factors such as education, as well as compound factors such as land tenure and the sharing of sanitation facilities. Tenants are willing to pay for better sanitation services, and landlords stand to benefit by investing in quality

housing with good quality sanitation facilities that are well maintained by the users. Other dynamics within informal settlements, such as relations between residents as well as norms, also play a role in influencing payment for sanitation, and it is important that they are taken into consideration when planning sanitation interventions.

5.7 Implications for policy and areas for further research

The findings of this study have an implication for both sanitation promoters and policy makers. The cost of sanitation as reflected in the rental prices shows that tenants in informal settlements would benefit greatly from sanitation, but cost is a major factor that limits sanitation acquisition. For promoters it is crucial to identify affordable sanitation technologies and determine a minimum cost that will not lock out the poor. After the identification of an appropriate sanitation technology, policy makers need to liaise with landlords and tenants in informal settlements and identify strategies that will ensure minimum sanitation provision in informal settlements, especially for those who may not be able to afford sanitation. Possible avenues for ensuring access could include subsidising the cost of sanitation or providing opportunities for access to finances for installing sanitation facilities. Instead of money, subsidies/finances could also be in the form of construction materials provided to landlords in the form of loans. Such financial approaches, however, should have adequate monitoring and repayment strategies. It is also necessary that approaches involve training the semi-skilled individuals in the settlements so that they can improve the services they offer.

For further research it is necessary to identify and test possible sanitation technologies, as well as to estimate their costs. Such estimation should include other expenses that are likely to be incurred, such as costs of repair and faecal sludge management.

CHAPTER 6: DETERMINANTS OF QUALITY OF SHARED SANITATION FACILITIES IN INFORMAL SETTLEMENTS OF KISUMU, KENYA[17]

6.1 Abstract

The sharing of sanitation facilities is common in informal settlements that host a large proportion of urban residents. Shared sanitation facilities, however, are not recognised as improved sanitation facilities due to challenges of maintenance, as they easily can be avenues for the spread of diseases. Such a realisation calls for an assessment of these shared facilities, especially in informal settlements, where they are common. A shared facility can thus be equated to a common good whose management depends on the users. If users do not work collectively towards keeping the facility clean, it is likely that the quality may depreciate due to the lack of maintenance. This study therefore used the common pool resource (CPR) management principles to understand the complex dynamics of shared sanitation facilities in the informal settlements of Kisumu, Kenya. Using a multiple case study design, the study used both quantitative and qualitative data to understand the determinants of shared sanitation quality. The users of shared sanitation facilities were interviewed, while shared sanitation facilities were inspected for quality. Shared sanitation quality was a score which was the dependent variable in a regression analysis. Interviews during the qualitative stage were aimed at understanding management practices of shared sanitation users. Qualitative data was analysed thematically by following the CPR principles. The results indicate that shared sanitation facilities, most of which were dirty, were shared by an average of eight households, and that their quality decreased with an increase in the number of households sharing them. The effect of numbers on quality is explained by the CPR principles, as it was easier to define boundaries of shared facilities when there were fewer users who cooperated towards improving their shared sanitation facility. Other factors, such as social norms, were also noted to play a role in influencing the behaviour of users towards ensuring that the facilities were functional. The CPR principles thus form a crucial lens through which the dynamics of shared sanitation facilities in informal settlements can be understood. Development and policy efforts should incorporate group behaviour as they determine the quality of shared sanitation facilities.

Key words:

Sanitation quality, Common pool resources, Management principles, Collective action, Behaviour

[17] Part of the results of this paper were summarised in a poster presented at the Tropical Institute of Community Health (TICH) and Development conference at the Great Lakes University of Kisumu (GLUK), 29 April to 1 May 2015; and an oral presentation at the WEDC conference in Kumasi, Ghana 11-15th July 2016. The paper has been submitted to BMC Public Health journal.

6.2 Introduction

Due to the rising rates of urbanisation and informality, providing adequate sanitation in informal settlements is increasingly becoming a challenge (Heijnen *et al.*, 2015). Inadequate individual household sanitation facilities in informal settlements force residents to share the few available facilities, a practice that some authors have proposed as being the most practical alternative (Schouten & Mathenge, 2010; Kabange & Nkansah, 2015). In the classification of sanitation facilities, however, the Joint Monitoring Program (JMP) of the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) does not classify shared sanitation facilities as 'improved' facilities due to concerns related to cleanliness, maintenance and distance from users' homes (UNICEF & WHO, 2008).

In addition to cleanliness and maintenance, studies have also highlighted the importance of aspects such as hygienic status of sanitation facilities, state of the superstructure, presence of smell, presence of flies, and the state of the slab (especially in the case of pit latrines) in defining the quality of shared sanitation (Montgomery *et al.*, 2010; Freeman, Greene, Dreibelbis, Saboori, Muga, *et al.*, 2012; Dreibelbis, Greene, Freeman, Saboori, Chase, *et al.*, 2013; Giné Garriga & Pérez Foguet, 2013; Sonego & Mosler, 2014; Nakagiri *et al.*, 2015). What is evident from these studies is that quality of sanitation facilities is determined by maintenance practices such as cleaning or lack thereof.

Unclean shared facilities may thus be due to a number of factors, including inadequate management practices of users. This inadequacy may lead to a scenario where users benefit from a shared sanitation facility, but put little or no effort into its management. This scenario is similar to one depicted by Hardin (1968:1244) as "the tragedy of the commons", where no one wants to make personal sacrifices for the good of all users. This theory of the "commons" defines a common good or resource as one that can be utilised by all, but that is not owned by any one user. Every user maximises benefits from the good/resource, but the costs are shared by all (Quinn, Huby, Kiwasila & Lovett, 2007). For such goods it is difficult to exclude any of the users, yet overexploitation or overconsumption takes away the ability of other users to use the same resource (subtractability), and eventually leads to depletion (Booth, 2012; Weeden & Chow, 2012; Araral, 2014). Applying this theory to sanitation, shared sanitation facilities may be equated to common goods, since it is difficult to exclude users who benefit from using these facilities. However,

overexploitation (such as misuse and lack of cleaning) reduces the ability of other users to use the sanitation facility.

To solve the challenges of common goods, Elinor Ostrom advanced the theory of self-governance or community governance (Ostrom, 2000, 2010). She identifies and recommends elements/conditions that would encourage users to work towards a common end of ensuring the sustainability of common resources. She calls these elements common pool resource (CPR) management principles, and they are:

1a. User boundaries: Boundaries between legitimate users and non-users must be clearly defined.
1b. User boundaries: Clear boundaries are present that define a resource system and separate it from the larger biophysical environment.
2a. Congruence with local conditions: Appropriation and provision rules are congruent with local social and environmental conditions.
2b. Appropriation and provision: The benefits obtained by users from a common-pool resource, as determined by appropriation rules, are proportional to the amount of inputs required in the form of labour, material or money, as determined by provision rules.
3. Collective-choice arrangements: Most individuals affected by the operational rules can participate in modifying the operational rules.
4a. Monitoring users: Monitors who are accountable to the users monitor the appropriation and provision levels of the users.
4b. Monitoring the resource: Monitors who are accountable to the users monitor the condition of the resource.
5. Graduated sanctions: Appropriators who violate operational rules are likely to be assessed graduated sanctions (depending on the seriousness and the context of the offense) by other appropriators, by officials accountable to the appropriators, or by both.
6. Conflict-resolution mechanisms: Appropriators and their officials have rapid access to low-cost local arenas to resolve conflicts among appropriators or between appropriators and officials.
7. Minimal recognition of rights to organise: The rights of appropriators to devise their own institutions are not challenged by external governmental authorities.
8. Nested enterprises: Appropriation, provision, monitoring, enforcement, conflict resolution and governance activities are organised in multiple layers of nested enterprises (Dietz *et al.*, 2008; Cox *et al.*, 2010; Janssen, 2015).

These principles have been applied in various disciplines to study the sustainability of institutions and resources such as forestry (Nagendra & Ostrom, 2012; Fleischman, Garcia-Lopez, Loken & Villamayor-Tomas, 2013), tourism (Heenehan, Basurto, Bejder, Tyne, Higham, *et al.*, 2015), agriculture (Quinn *et al.*, 2007; Moritz, Scholte, Hamilton & Kari, 2013) and water and marine resources (Mills, Pressey, Ban, Foale, Aswani, *et al.*, 2013; Colin-Castillo & Woodward, 2015; Leonard, Walton & Farbokto, 2015). It is acknowledged that these principles may not be applicable in all contexts, but they work well in self-governing institutions that require coordination and collective action from users (Agrawal, 2014). It is therefore important to understand the local context within each system when applying the CPR principles (Sarker & Itoh, 2001; Ostrom, 2008; Wilson *et al.*, 2013; Saunders, 2014). In this regard, therefore, and in the context of shared sanitation in informal settlements:

- A shared sanitation facility can be equated to a scarce resource (like the CPR).
- Management of the facility is done by the users (appropriators).
- Quality and continued use of the shared sanitation facility depends on the users' management practices.

In urban areas, a household's benefits from sanitation depend largely on the actions of others (Mcgranahan, 2015; O'Keefe, Messmer, *et al.*, 2015) and the CPR management principles are a possible avenue to an in-depth understanding of group actions influencing shared sanitation quality. I have not come across any studies that have applied CPR theory to the study of shared sanitation facilities in informal settlements; thus, the aim of this study was twofold: To examine the quality of shared sanitation facilities in informal settlements, and to assess the determinants of shared sanitation quality. In order to examine the quality of shared sanitation facilities, it was assumed that factors such as construction materials and number of users are critical. These users also determine management practices, and the CPR management principles formed the lens through which management was examined. In order to contextualise these issues, this paper will give an overview of the study area, and describe the methods used to address the aims of the study. The results of the study are then presented, after which a discussion and a conclusion follow, and finally a section on recommendations.

6.3 Study area

Details about the study area have been detailed in section 3.3, as well as chapter 4 and 5.

An earlier study by Okurut and Charles (Okurut & Charles, 2014) revealed that 65% of the population in the settlements have access to 'improved' sanitation (as defined by the JMP). Nonetheless, the study pointed out that most of these facilities did not count as providing sustainable access to basic sanitation judging from indicators such as safety, privacy, dignity, and cleanliness. The prevalent practice of flying toilets (Karanja, 2010) is an indication of a total lack of sanitation facilities, although it also may be an indication of the dysfunctional and inadequate sanitation facilities. Dysfunctional sanitation facilities could be due to poor construction (resulting in the collapse of pit latrines) or improper management practices, which also may drive residents to open defecation. Such gaps, therefore, were the impetus for this study.

6.4 Methods

6.4.1 Study design

Using a multiple case study design approach, this research combined quantitative and qualitative methods (as detailed in section 3.5.2) to address the study objectives. Data collection and the results of the quantitative stage will be presented first, followed by the qualitative results. The discussion will be a synthesis of both the quantitative and qualitative data.

6.4.2 Quantitative stage

Sampling and sample size

The quantitative stage of this study occurred during the initial cross-sectional study, and thus sample size, sampling and data collection have already been detailed in sections 3.5.2. However, it needs to be noted that compounds that were of interest in this stage were only those that had sanitation facilities that were shared by at least two households.

Data collection and initial analysis

During the interview process described in section 3.5.1, the respondents were asked questions relating to the type of residence, the location of the toilet and the users of the toilets. After the interview, the shared sanitation facility was inspected using an inspection tool that captured aspects related to construction materials of the facilities, location of the toilet, a rating of the cleanliness of the facility (from very dirty to very clean), as well as components of quality (Appendix 3). These components that defined shared sanitation quality were hygiene factors, privacy factors and slab factors. A number of questions defined these components, as shown in Table 6.1.

After collection, the data were entered into Epi-Info, checked for errors, and transferred to Stata (v 13) for analysis. The data were then summarised using descriptive statistics. Some aspects of shared sanitation maintenance had been raised during the quantitative data collection and analysis. Some of these aspects included reasons why some of the shared sanitation facilities were dirty, and how the clean facilities were kept clean. But since such aspects were beyond the scope of the quantitative survey and the data collection tool, a qualitative study was then designed using the CPR perspective.

Table 6.1 Quality of shared sanitation facility score sheet

Quality Factors	**Yes**	**No**
1. Hygiene factors		
Is there faecal matter on the slab?		
Are there flies in the facility?		
Is there a smell from the facility?		
Is there a nearby hand-washing facility?		
Total hygiene score (max 4)		
2. Privacy factors		
Does the facility have a door?		
Can the door be locked? i.e. does it hold in place		
Does the door have a locking latch?		
Does the door offer privacy? i.e. no cracks		
Does the facility have a complete superstructure?		
Does the superstructure offer privacy? i.e. no cracks on the superstructure		
Does the facility have a roof?		
Does the roof offer privacy, i.e. no cracks?		
Total privacy score (max 8)		
3. The slab and other visible factors		
Are there cracks/visible spaces on the slab?		
Is the drop hole too big? (bigger than the size of a foot)		
Is the drop hole open? (no evidence of a cover)		
Are there standing fluids on the slab?		
Is the facility full?		
Is the facility semi-full?		
Total slab score (max 6)		
Total quality score (max 18)		

6.4.3 Qualitative stage

Sampling and data collection

This stage was driven by the inadequacies of the previous quantitative stage such as little details in answering the 'why' questions. Data were collected from the same informal settlements and clusters that were selected during the cross-sectional study, as described in section 3.5.2.

The interview guide was designed with questions related to the management of shared sanitation facilities, as per the CPR principles (section 6.2 above, and

Appendix 4). The principles were reviewed to ensure that they were applicable to the local context and to sanitation, hence:

a. Boundary definition of users, as well as of the shared sanitation facility.
b. Presence (or absence) of management rules/structures.
c. Contribution by individuals to the common good of the shared facility (e.g. cleaning).
d. Collective decision making.
e. Monitoring of the sanitation facility.
f. Sanctions.
g. Conflict and its resolution.

The interview guide also covered aspects of residence type, as well as number of households sharing the sanitation facilities.

The process of selection and interviewing continued in the four settlements until no new information was forthcoming, by which time a total of 40 respondents had been interviewed and the 40 toilets within their compounds also inspected.

6.5 Data management and analysis

Quantitative data from all the inspected sanitation facilities were entered into Epi-Info, checked for errors, and then transferred to Stata (v 13) for analysis.

The quality of the shared sanitation facilities was the dependent variable, calculated as a score, summed from each of the three main factors (hygiene, privacy and state of the slab). For hygiene and slab factors, if the answer to any of the questions was no, the facility scored 1, otherwise it scored 0. However, it was the reverse for the availability of a hand-washing facility: 1 if yes, and 0 if no. For privacy-related factors, the score was 1 if the answer to any of the questions was yes, and 0 if otherwise. Facilities were classified as 'dirty' if there were visible faeces or other waste materials on the toilet slab, or if the facility was full. Otherwise, they were classified as 'clean'.

Descriptive statistics (means, standard deviations, frequencies and percentages) were first used to summarise the variables. Pearson's correlation was then used to assess linear correlation among the independent continuous variables.

To examine the determinants of quality, a standard multiple linear regression was performed with the total quality score as the dependent variable. The independent variables were settlements, superstructure and slab construction materials, location of the toilet, types of users, and number of households sharing a toilet. Two

hypotheses were being tested, namely that poor-quality construction materials of the superstructure and the slab lead to lower quality of shared sanitation facilities; and that more users sharing a sanitation facility result in lower quality of the sanitation facility. White's test was used to check for heteroscedasticity, and the variance inflation factor (vif) was used to assess multicollinearity among the independent variables. Associations were tested at the 95% confidence level.

For the qualitative phase, initial analysis of data began while conducting field work to identify and refine any emergent issues that may have been missed and needed follow up in subsequent interviews. After data collection, all recordings were replayed in order to get an overall understanding of each respondent's story. The interviews were transcribed verbatim in Microsoft Word, and then re-read again. The transcripts were then transferred to ATLAS.ti software. In ATLAS.ti, analysis followed a thematic content analysis approach (Green & Thorogood, 2014). The transcripts were first coded based on frequently appearing words or issues (for instance, locking latrines). The codes were then merged into families which were the CPR themes that had been identified a priori (such as defined boundaries of a compound). The themes were then summarised in a matrix, (referred to as the Primary Documents table in ATLAS.ti, and presented in table 6.4) which presented the frequencies of these themes and codes within the shared sanitation facilities. Such a matrix revealed some cases that were 'out of the norm', commonly referred to as deviant cases. Such cases often prompted the researcher to revisit the transcripts, compare the coding, and relate the cases to the theories in order to obtain a deeper understanding. This process led to finer explanation on possible reasons for the quality of shared sanitation facilities experienced during the quantitative stage. The convergence of the quantitative and qualitative findings was then reconciled at the point of interpretation of the data (analytic or interpretative integration) (Moran-Ellis, Alexander, Cronin, Dickinson, Fielding, *et al.*, 2006) by linking the CPR theory to shared sanitation quality in order to provide a richer discussion.

6.6 Results

6.6.1 Quantitative results

All the inspected facilities were pit latrines shared by an average of eight households. From observations, most of the facilities (64%) were dirty (either slightly dirty or very dirty). Table 6.2 summarises the number of facilities that had the indicators of quality as per the inspection tool.

Table 6.2: Totals of shared sanitation facilities that exhibited the indicators of quality

Quality Factors	Yes	No
1. Hygiene		
Faecal matter on the slab	68	57
Flies in the facility	47	78
Smell from the facility	97	28
A nearby hand-washing facility	0	125
2. Privacy		
Presence of a door	122	3
The door holds in place	120	5
The door has a locking latch	106	19
The door offers privacy	110	15
The facility has a complete superstructure	108	17
The superstructure offers privacy i.e. no cracks on the superstructure	96	29
The facility has a roof	94	31
The roof offers privacy i.e. no cracks	81	44
3. The slab and other visible factors		
Cracks/visible spaces on the slab	39	86
A drop hole that is too big (bigger than the size of a foot)	34	91
An open drop hole (no evidence of a cover)	124	1
Standing fluids on the slab	66	59
Full facility	28	97
Semi-full facility	75	35

Seventy-five percent of the facilities had roofing made from iron sheets, 51% had the superstructure constructed with bricks/stone, and 88% had a concrete slab. Compounds with clean toilets had an average number of seven households sharing the sanitation facilities, while dirty sanitation facilities had a mean of nine households. The facilities performed better in privacy (mean 6.7) aspects, compared to hygiene and slab conditions (means of 1.1 and 2.9 respectively). These results are summarised in Table 6.3, and some photos showing the shared facilities are in Appendix 7.

From Spearman's correlation analysis, linear correlation among the independent variables was weak, below 0.4. Regression analysis results indicated an inverse relationship between quality and number of household users ($p=0.04$; CI-0.22- -0.001). The results suggest that, for every one increase in the number of household users, quality reduced by 0.1 scores. Sanitation facilities constructed with a brick superstructure had two scores of better quality compared to sanitation facilities with iron sheets/mud/wood superstructure ($p<0.01$; CI 0.91-3.11) (Table 6.4). These results led to the acceptance of the hypotheses that shared sanitation facilities with more people have lower quality, and that poor construction materials lead to lower quality of shared sanitation facilities.

Table 6.3: Descriptive summary of variables of shared sanitation facilities in Kisumu's informal settlements.

Variables	Frequency (%)
Area	
Bandani	29 (23.2)
Nyalenda A	31 (24.8)
Nyalenda B	34 (27.2)
Obunga	31 (24.8)
Roof material	
None	31 (24.8)
Iron sheet	94 (75.2)
Superstructure material	
Iron sheet/mud/wood	61 (48.8)
Bricks/stone	64 (51.2)
Floor/slab material	
Mud/wood	15 (12)
Stone /slab	110 (88)
Location of toilet	
Outside compound	25 (20)
Inside compound	100 (80)
Toilet users	
Owner and tenants	38 (30.4)
Tenants and caretaker	38 (30.4)
Tenants only	49 (39.2)
Rated cleanliness	
Very clean	15 (12)
Clean	30 (24)
Dirty	53 (42.4)
Very dirty	27 (21.6)
Number of households sharing	Mean 8.4 (2-27) Std dev 4.7
Hygiene score	Mean 1.3 (0-3) Std dev 1.1
Privacy score	Mean 6.7 (2-8) Std dev 1.6
Slab score	Mean 2.9 (0-6) Std dev 1.4
Total quality score	Mean 10.9 (5-17) Std dev 3.1

However, for the slab material there was no evidence to reject the null hypothesis (p=0.13, CI-0.39-2.99), leading to the conclusion that there was no difference in quality between the slab construction materials. Results indicated no quality difference based on the type of residence (tenants only or tenants with caretaker).

The final model had a mean variance inflation factor of 1.5, which indicated that the independent variables did not have linear combinations. White's test for heteroscedasticity produced a chi square value of 54.1, with a p-value of 0.08, thus showing that there was no heteroscedasticity. The R-squared value of the final regression model suggested that the variables in the model explained only 26% of the

shared sanitation quality. It was assumed that more factors, i.e. management practices, would further explain the quality of shared sanitation facilities.

Table 6.4 Multiple regression analysis of determinants of shared sanitation quality in Kisumu's informal settlements.

Variables	**Regression Coefficient**	**Std Error**	**P values (CI)**
Number of households sharing the facility	-0.11	0.05	0.04 (-0.22 - -0.001)*
Toilet located within the compound	0.9	0.67	0.19 (-0.45 -2.19)
Superstructure			
Bricks/stone superstructure	2.01	0.56	<0.01 (0.91 -3.11)*
Slab material			
Concrete/stone slab	1.30	0.86	0.13 (-0.39 - 2.99)
Residence type/users			
Tenants and caretaker	-0.15	0.67	0.81 (-1.48 – 1.18)
Tenants only compounds	-0.85	0.64	0.19 (-2.13 - 0.42)
Area			
Nyalenda A	-0.80	0.77	0.31 (-2.33 - 0.72)
Nyalenda B	-0.16	0.75	0.83 (-1.64 – 1.33)
Obunga	-0.13	0.80	0.87 (-1.71 – 1.45)
R^2	0.26		
F(9, 115)	4.4		
Prob (F-statistic)	0.00		
N	125		

*Significant at the 0.05 CI

6.6.2 Application of the CPR management principles (qualitative results)

Boundary definition was reported and observed in all the clean facilities, and most households mentioned defined cleaning arrangements and collective decision making. Conflicts over the use of the facilities were experienced less among the clean sanitation facilities, compared to dirty facilities where it was experienced more. Rules of use, monitoring, as well as sanctions were reported less in compounds with dirty toilets. The applicability of each of these principles is as explained below:

Boundary definition

Boundaries were demarcated in various ways: Toilets were situated within fenced and/or gated compounds and they were locked using padlocks. In compounds where the toilets were locked, each household had a copy of the keys or one key was shared by at least two households. In other cases the keys were situated at strategic positions where they were easily accessible to everyone within the compound.

> *"The caretaker locks the toilets, but he keeps the key where we can all get it whenever we want to use the toilet."* [A female tenant]

> *"We hang it [the key] outside where others [compound members] can access it."* [A female tenant]

Users acknowledged that the toilets were locked to keep intruders, who often left the toilets dirty, away.

> *"We keep them [toilets] locked because other passers-by and people from neighbouring compounds would want to use them."* [A female tenant]

The breaking of padlocks (in order to use the toilets) and stealing of materials used for the construction of the facilities, were also reported.

> *"… if a toilet is located outside the compound, people break it [the padlock] … sometimes they steal the iron sheets …"* [A male tenant]

Cases of users losing their keys, which eventually led to the toilets not being locked, were also reported. Such toilets were an easy target for illegitimate users, especially if they were not within fenced or gated compounds.

In most cases, dirty facilities were left open for all to use, including members of other compounds. Users from compounds with such dirty and 'open for all' toilets did not feel the need to block outsiders from using their facilities. A male tenant, when asked why they do not lock their toilet that was situated outside the compound answered:

> *"How and why should one prevent outsiders from using such a toilet? It is already too dirty."*

Cleaning arrangements and rules of use

Toilet cleaning structures or patterns varied in the informal settlements. Defined cleaning structures were commonly in the form of a duty rota, and each household had a specific day(s) when they cleaned toilets. This often was not a written rota per se, but rather households followed an order (e.g. arrangement of houses within the compound) that ensured that all users participated in cleaning the toilet. Such structures worked best in compounds with fewer households who had good relations among themselves. Women were mostly responsible for cleaning the toilets.

> *"I clean on Monday and Wednesday, and the others also have two days of the week when they clean."* [A female tenant]

In some compounds with live-in landlords, the landlords cleaned the toilets without involving tenants.

> *"The landlord cleans the toilets himself, he never asks us to clean."* [A female tenant]

A male landlord explained why he cleans the toilet by saying:

> *"Tenants will not agree to do it [clean the toilet]. They say the compound is mine … I cannot force them to do it."*

However, even with defined cleaning arrangements and rules of use, some users did not perform their cleaning duties as expected. At other times, when the person responsible had cleaned the toilets, other compound members soiled them, which led to other users not carrying out their cleaning responsibilities. A female tenant explained that it was common for other users to soil the toilets after the person responsible had cleaned them. When asked what she did in such a situation, she said:

> *"If someone else soils it [the toilet], I will ask them to clean it; alternatively I just leave it dirty."* [A female tenant]

Another female tenant expressed her displeasure at the dirty toilet that they used, which was located outside the compound. She expressed that she was often cleaning the toilet even though everyone was required to clean it. When asked why she did not ask her colleagues to clean when it was their turn, she said

> *"When I ask someone to clean the toilet, this is what they ask me: 'Why should I clean this toilet that is by the roadside, and is used by everyone?'"*

In compounds where cleaning rules and/or management structures were not well defined, toilets were often left dirty and would only be cleaned by any member who volunteered to clean. A male tenant explained that there were no structures in place to ensure that their toilet was kept clean. He remarked:

> *"Nobody cares about this toilet … whoever is willing to clean it will do it …"*

When no one was willing to clean such toilets, they remained dirty, often for a number of days. When someone eventually volunteered to clean them, the common

practice was to simply pour dirty soapy water, which had been used to clean clothes, over the toilet slab.

Women often volunteered and took on the responsibility of ensuring the cleanliness of shared sanitation facilities in order to protect their children from using unhygienic sanitation facilities. One female tenant explained why she cleaned the toilet in their compound every day without relying on anyone:

> *"I clean the toilet … because I have children … I do not want them to use a dirty toilet."*

Aside from women volunteering to clean toilets, it was commonly felt in most compounds that cleaning toilets was a woman's responsibility, and thus men were sometimes exempted from cleaning/management activities. However, in other compounds, all users were required to clean the toilets, irrespective of their gender.

It was further noted that, in some compounds, there had been a cleaning and/or management structure that was abandoned when users did not adhere to the rules. When rules were not adhered to, the toilet often was either left dirty, or would be cleaned by anyone who volunteered.

> *"We previously had a rota for cleaning the toilet, but members started complaining, and they refused to clean the toilet. Eventually no one cleans it."* [A female tenant]

Collective decision making

Meetings were held in some compounds, and all members were required to attend. During such meetings, issues affecting members were raised and discussed, with sanitation being one of the issues that were discussed. Such meetings often led to collective decisions and the formulation of rules for the management of sanitation facilities.

"We, the tenants, held a meeting and all agreed to it [toilet cleaning plan] [a female tenant]

These meetings were easier to coordinate in compounds with fewer households, or in compounds with a leader, such as a landlord or the caretaker. The leader ensured that all users participated in decisions, and that they carried out their duties as agreed upon in the meeting. On the other hand, it was difficult to arrive at a

consensus in compounds with many members, even when there was a leader, often due to differences in opinion, uncooperative members, or the unavailability of all members during decision-making meetings.

Monitoring

Monitoring was done to check on illegitimate users as well as on the condition of the toilets. In compounds with tenants only, one of the tenants would sometimes act as the leader, and in compounds with a live-in landlord, the landlord automatically took up the responsibility. One female landlord explained what she does to ensure that the toilet is clean:

> *"I monitor the cleaning and use of the toilet myself, am very strict, they know it."*

Other compounds had caretakers who took up this role.

Monitoring was done in various ways. For example, it is common for residents within the informal settlements to sit outside their houses during the day and, by so doing, they would easily identify any illegitimate users. In some tenant-only compounds, tenants themselves acted as monitors, a practice which was only successful when they had good relations among themselves. A female tenant, who lived in a compound of three households, mentioned that they did not have any one person responsible for monitoring their toilet, but that they all did it together. When asked how they do it, she explained:

> *"We are all responsible, for example, if someone from a neighbouring compound comes to me asking to use the toilet, my next-door neighbour will not allow them."*

Compounds with defined boundaries, such as fences and gates, needed less monitoring, as it was not easy for outsiders to sneak in and use the toilets; the reverse was true for compounds without defined boundaries.

Conflict and its resolution

Cases of conflict were reported in instances when users soiled sanitation facilities after they had been cleaned. Conflicts were reported among women, especially if children dirtied the toilets and their guardians did not clean them. These conflicts

were at times physical fights, disagreements, exchange of words, or quarrels among compound members. At times conflict was experienced in a subtle way, for example,

> *"It [conflict] happens; people sulk at each other, others talk ill of those who dirty the toilet."* [A female tenant]

It was also noted that, with no cleaning or management arrangements and rules in place, users in compounds with dirty toilets often experienced little or no conflict, since no one was charged with the responsibility of cleaning the toilets. Conflicts were resolved in various ways, including discussing the issues with the concerned parties, either individually or collectively, or involving a third party – often the leader.

> *"I always have a meeting with them when we have a problem."* [A male Landlord]

Sanctions

Few forms of sanctions were reported. In most compounds, sanctions were administered by the other compound members or the leader. Reported sanctions included buying new padlocks when keys were lost, reporting un-cooperating tenants to the leaders, or being forbidden to use the toilet if anyone lost the keys. One female tenant, who lived in a compound without a live-in landlord explained how they (the tenants) punished a tenant who did not adhere to the rules:

> *"We report him [an un-cooperating tenant] to the landlord."*

Sometimes the landlord gave an un-cooperating tenant a warning especially when they refused to abide by cleaning rules. If such tenants continued being un-cooperative, they were asked to vacate the compound. A male landlord explained that he was very vigilant in ensuring that the tenants in his compound kept the toilet clean. When asked what he did if there were any tenants who did not follow the set cleaning rules, he explained:

> *"I give the [uncooperative] tenant three chances, after which I ask them to vacate the compound."* [A male Landlord]

In extreme cases, one landlord explained that when tenants stubbornly refused to abide by the toilet rules in the compound such as not cleaning the toilet after they soil it, they were reported to the local chiefs.

These practices were noted in some compounds, but not in others. Table 6.5 gives a summary of the applicability of these principles in the clean and dirty sanitation facilities.

Table 6.5 Summary of applicability of CPR principles in shared sanitation facilities in Kisumu's informal settlements*

	Management principles	**Clean**	**Dirty**
1	Defined boundaries of compound and toilet	17	7
2	Defined cleaning arrangements	15	7
3	Users participate in decisions collectively	9	4
4	Users experience conflict	1	8
5	Conflict resolution mechanisms	1	2
6	Monitoring of the toilet and users	12	9
7	Defined rules of use	5	2
8	Sanctions	6	2
9	Tenants only compounds	4	7
10	Live in landlord compounds	6	13
11	Caretaker present compounds	7	3
12	Total number of inspected sanitation facilities	17	23

*Summarised from primary documents table of ATLAS.ti software

6.7 Discussion

Shared sanitation facilities are classified as unimproved sanitation facilities by the JMP because, among other reasons, of the difficulty of keeping them clean (UNICEF & WHO, 2008). Defining the quality of shared sanitation facilities is critical if they are to be considered as improved sanitation by the JMP. In this study, shared sanitation quality was measured as a total entity that included the roof, superstructure, as well as hygienic conditions. Most of these indicators were used in other studies (Montgomery *et al.*, 2010; Freeman *et al.*, 2012; Dreibelbis *et al.*, 2013; Giné Garriga & Pérez Foguet, 2013; Sonego & Mosler, 2014; Nakagiri *et al.*, 2015; Kwiringira, Atekyereza, Niwagaba, Kabumbuli, Rwabukwali, *et al.*, 2016) that aimed at assessing the hygienic conditions of sanitation facilities. The advantage of using all these indicators as used in this study is that the measure of quality is all-inclusive, and not only focused on hygienic aspects. For example, anyone using a shared sanitation facility would be comfortable to use one that is not only clean, but also offers privacy and shelter from weather conditions such as rainfall.

Results of this study reveal that household shared sanitation facilities were pit latrines. These latrines were constructed using various materials including iron sheets. This variety in construction materials shows that residents used locally available (and affordable) materials for the construction of sanitation facilities.

Shared sanitation facilities with superstructure made from bricks had better sanitation quality, which is a pointer to the durability of materials used for construction. Bricks are likely to be more durable and have fewer crevices, and therefore offer better privacy. Iron sheets, on the other hand, are less durable, and residents are likely to use 'recycled' iron sheets to construct their toilets; which may have crevices that do not offer privacy. Moreover, due to a high water table that leads to the collapse of pit latrines in the study area, it is unlikely that one would construct a sanitation facility with a superstructure made of bricks and use poor quality slab material, because the toilet easily collapses. However, the opposite is likely, that superstructures made out of iron sheets are likely to have an alternative slab, such as wood, which, as noted from the observations, is not hygienically clean. Similar findings were reported in Uganda, where pit latrines with plastered brick superstructures were structurally sound compared to non-plastered latrines, which also showed signs of collapse during the rainy season (Nakagiri *et al.*, 2015).

Quantitative results further showed that the facilities performed better in privacy aspects compared to hygiene and slab aspects. A closer look at the scores of hygiene and slab aspects (such as faecal matter and fluids on the slab which can be a public health risk) points to the fact that the facilities were not adequately maintained. Similar results are reported in Western Kenya (Dreibelbis *et al.*, 2013) and Tanzania (Montgomery *et al.*, 2010) where although most facilities had complete superstructures, they were not hygienically clean as evidenced in their hygiene and slab aspects. Better performance of privacy aspects reveals that more attention is usually given to the provision of the 'structure' (hardware), and the poor performance in hygienic conditions points to less attention being given to the behaviour of users. Sustainability in sanitation is not only about the provision of hardware aspects. A great extent of shared sanitation quality is explained by 'soft' factors that are behavioural (2014a) and related to maintenance/management, and thus attention also needs to be directed to users' behaviour and practices.

To further examine the role of sanitation practices, findings revealed that the quality of shared sanitation decreased with an increase in the number of users, similar to findings from informal settlements in Uganda (Günther *et al.*, 2012; Tumwebaze, 2013; Kwiringira *et al.*, 2014a; Tumwebaze *et al.*, 2014). The relationship between increasing number of users and decreasing quality, especially in informal settlements, is explained by users' behaviour. Studies have related the cleanliness of

shared sanitation to individual behaviour (Sonego & Mosler, 2014; Tumwebaze & Mosler, 2014a; Tumwebaze *et al.*, 2014; Kwiringira *et al.*, 2016) such as having the intention to clean sanitation facilities. However, qualitative findings from this study suggest that all users may not share the same intent or have the same attitude. In addition, one individual's effort may not be as productive as a group's effort, and it is, therefore, important to investigate group dynamics and behaviour, especially with shared sanitation. Group dynamics, provide a more holistic picture as opposed to an individual's actions, which may or may not have as significant an effect on quality as the actions of a group would, hence the application of the CPR principles.

One of the CPR principles is boundary definition, and in the context of shared sanitation in informal settlements, it included strategies like locking shared toilets and having the toilets located in fenced compounds to keep intruders away. Such practices have also been reported in informal settlements in Nairobi (Wegelin-Schuringa & Kodo, 1997), Uganda (Kwiringira *et al.*, 2014a, 2016) and India (McFarlane & Desai, 2015). Defining boundaries is crucial because it identifies legitimate users, and it becomes easier to coordinate efforts among the legitimate users. Having a defined user group is also important in defining and implementing management structures and practices like cleaning, collective decision making, and monitoring. A defined user group and management structure do not, however, guarantee that facilities will be in proper hygienic conditions. Results of the current study, as well as studies from Nairobi [58] and Bangladesh [60], show that some management system such as cleaning rotas break down after some time, implying that there is more that explains the quality of shared sanitation other than the users, defined boundaries and defined management structures.

In addition to users, defined boundaries, and defined management structures; cooperation from and among users is equally vital. Cooperation results when users are in communication, and it ensures that sanitation facilities are kept clean, the defined structures are implemented, monitoring and sanctioning are implemented, and conflicts are resolved. One way of attaining cooperation in groups is through collective decision making. Collective decision making ensures that decisions that are arrived at are favourable to everyone. Qualitative results, for example, indicated that residents who lived in compounds with dirty facilities rarely made decisions collectively. When users are in agreement, it is possible and easier to organise for collective action to ensure that shared facilities are of acceptable quality.

McGranahan (2015) also highlights the importance of collective action in sanitation by noting that when there is collective action, it becomes possible to solve local sanitation challenges.

It is also indicative from this study that management practices are interrelated, each working with another to influence the quality of sanitation facilities. For example, with a defined user group, proper management structures, and collective decision making; monitoring, implementing sanctions, and conflict resolution are easier. These practices were rarely carried out in compounds with dirty sanitation facilities in this study. Therefore, it is possible to effect some of the CPR management practices but still, have dirty sanitation facilities.

Such a scenario where some management principles are implemented but shared facilities are not hygienically clean can partly be related to the number of users. Relating back to the issue of numbers, this and other studies (Günther *et al.*, 2012; Tumwebaze, 2013; Kwiringira *et al.*, 2014a; Tumwebaze *et al.*, 2014) show decreasing sanitation quality with increasing number of users. A large number of users is difficult to coordinate, make decisions collectively, and implement rules. It is difficult for people in large groups to trust all other participants, hence making it easier to free ride on the actions of others (2015). Consequently, sanctions may not be easily implemented and effected, and conflict, which is mostly due to the neglect of responsibilities may arise, as reported in India (Reddy & Snehalatha, 2011) and Ghana (Appiah & Oduro-Kwarteng, 2011a). On the other hand, it may be possible to have a smaller number of users and also have dirty sanitation facilities. Such a situation may arise when for example, the few users do not have defined boundaries and management structures and do not collectively make decisions.

On the issue of numbers and in line with the discussion on classifying shared sanitation as improved or not, some authors have proposed minimum or maximum numbers allowable for sharing. Gunther *et al.*'s (2012) study recommended that facilities be shared by a maximum of four people. Kabange and Nkansah (2015) suggest sharing with 2-3 families. One limitation of this study, though, is that it was not possible to establish a threshold number. Although it is clear that shared sanitation quality decreases with increasing number of users, it should be noted that the size of a household is crucial in defining a threshold. For example, compounds may have a number of housing units, which may be occupied by one individual in

each unit. Individuals in such a compound may be able to work collectively and keep their sanitation facilities clean. Alternatively, a compound with a similar number of housing units that are occupied by families with an average of five members may have dirty shared facilities. Again, as earlier discussed, it is also possible to have fewer households sharing sanitation facilities but still have unhygienic and dirty facilities. Therefore, focusing on numbers alone is not enough to make recommendations; other determinants beyond the numbers are also important.

Aside from the already discussed CPR principles, another determinant of shared sanitation quality is the importance of good relations among users of sanitation facilities. With good relations, users can, for instance, take on other users' roles in cleaning sanitation facilities, or they are likely to resolve issues amicably thus resulting in less conflict. Good relations between landlords and tenants may also lead to productive management practices, even without the use of sanctions or monitors. For example, some individual tenants participated in the management of shared sanitation because it was a norm that every user should take part in management. Non-participation in behaviour such as cleaning can be viewed as 'abnormal' and is part of the reason why landlords were ready to evict non-cooperative tenants. Hence, it is possible that even when sanitation facilities are shared by many households and it may be expected that their sanitation facilities be dirty, there may be social rules and norms that guide users in ensuring that these facilities are kept clean. The CPR literature also proposes that where there are no rules, social ties may reduce conflict and facilitate the development of rules or social norms, which lead to the growth of beneficial behaviour that encourages cooperation (Bodin & Crona, 2009; Ostrom, 2012; Agrawal, Brown, Rao, Riolo, Robinson, *et al.*, 2013).

Further noted in this study were the aspects of gender and the role played by individual efforts that contributed to the good quality of shared sanitation. Results showed that women were more likely to clean sanitation facilities rather than men. In addition, they volunteered to clean sanitation facilities because they had young children who would be exposed to the risk of disease. Women have often been responsible for sanitation, including cleaning, also reported among users of shared facilities in Uganda (Kwiringira *et al.*, 2014b) and India (Reddy & Snehalatha, 2011). However, when users depend on actions of specific individuals and do not put in

their own effort, it is possible that such beneficial actions of specific individuals may stop when circumstances change e.g. when children grow up, or when users relocate to other areas. Management of the shared sanitation facility may then end up being no one's responsibility. If only specific individuals participate in a group's common good, the practice may not be sustained long enough to ensure continued use of shared sanitation facilities. Eventually, as noted by Tumwebaze (2013) poor-quality sanitation facilities may not be used and users may resort to practices such as open defecation.

Conclusion

This study has highlighted that the quality of shared sanitation facilities is not only influenced by hardware aspects but also software aspects. Hardware aspects include construction materials, while software aspects include the behaviour and practices of users. Software factors, which were investigated using common-pool resource management principles, show the importance of group dynamics and practices because they determine the quality of shared sanitation facilities. Shared sanitation facilities should be located where illegitimate users will not have access, and the legitimate users should have a management system that they agree upon collectively. With cooperation, collective action is possible, as the group works together to ensure that sanitation facilities are in good condition. Such an environment also enables the development of social norms that guide other users towards responsible behaviour with regard to shared sanitation facilities. The CPR principles provided useful insights into the complex dynamics of shared sanitation management. Emergent from this study is that, in relation to sanitation in informal settlements, focusing only on numbers may suggest fewer number of users per facility, and consequently more sanitation facilities in informal settlements, both of which may not be feasible. Attention should also be directed at practices that ensure cooperation among users for their common good. Otherwise, 'access' to sanitation does not always mean 'use' of sanitation facilities.

Policy implications and recommendations for further studies

Policy makers and stakeholders, such as public health departments, should ensure that efforts are not only directed at increasing access but also at ensuring that shared facilities are in useable hygienic conditions. These efforts should involve stakeholders, such as landlords, tenants, and local leaders. As this study suggests,

shared sanitation facilities can be kept hygienically clean if there is collective effort from users. Therefore, for policy development, the focus should not only be on number of users sharing a facility but also on the behaviour and practices of the users. With such consideration, it means that if managed adequately, household shared sanitation in Kisumu's informal settlements may be considered as improved sanitation. Development efforts should in addition to the provision of sanitation, also include aspects of safe and hygienic use of shared sanitation facilities and proper disposal of human excreta. Hygienic use of sanitation facilities will ensure that there is sustained use of shared sanitation facilities. Follow-up studies could be carried out to determine the number of users who can share sanitation facilities while ensuring that there is cooperation and coordination amongst them towards a common goal.

Limitations

The study was carried out during the dry season, and it is possible that the results may be different during the rainy season. Being a case study design, the findings of this study are applicable within the context of Kisumu's informal settlements. This study may then be a basis for comparison with studies (perhaps with larger sample size) from other informal settlements.

CHAPTER 7: DECISION MAKING FOR SANITATION IN THE INFORMAL SETTLEMENTS OF KISUMU, KENYA

7.1 Abstract

Informal settlements are faced with sanitation challenges such as a total lack of or inadequate and poorly maintained sanitation facilities. As such, there have been various efforts that have been geared towards increasing the uptake of sanitation facilities. However, in informal settlements, the decision to install or clean a sanitation facility is not always clear cut, since landlords and tenants are involved. Moreover, sanitation decisions often involve various other stakeholders besides landlords and tenants. The aim of this study was to investigate the decision-making process for sanitation at the point of use (household level), and to use principles of transdisciplinary/action research to initiate decision making for sanitation at the community and city level. This study was carried out in the informal settlements of Kisumu, Kenya. Data were collected by interviewing household heads during the first stage of household decision making. Participatory group discussions and participatory workshops were used to facilitate a decision-making process in the second and third stages of community and city levels. Qualitative data were analysed thematically, with themes emerging from the data. The results indicate that, at the household level, landlords and tenants make different decisions, in different ways, and for various reasons. Landlords often make investment decisions, while tenants make management (such as cleaning) decisions. At the community and city level, several challenges facing sanitation, such as ignorance and the lack of proper technologies, were identified by stakeholders, who also identified opportunities for improvement. This study illustrates how sanitation decisions are made in informal settlements, and also that using approach mentioned in action research leads to the co-production of knowledge that is beneficial in the sanitation sector.

Key words:

Decision making, Sanitation, Informal settlements, Participatory, Transdisciplinary research, Kisumu, co-production

7.2 Introduction

Informal settlements are faced with several challenges, such as the total lack of, or inadequate, sanitation facilities. When they are available, sanitation facilities are shared, and often are poorly maintained and dirty (Günther *et al.*, 2012; Tumwebaze, 2013; Tumwebaze *et al.*, 2013), posing a health risk to their users. Such challenges have driven development partners to implement interventions aimed at increased demand and uptake of sanitation, such as sanitation marketing (Mara *et al.*, 2010). These interventions are drawn from recommendations from economics and behavioural studies that investigate the willingness to pay for new or improved technologies (Milanesi, 2010; Santos *et al.*, 2011). The underlying assumption is that, with increased demand, there will be increased uptake.

These studies have taken novel approaches and have yielded results that play a role in increasing access to sanitation. However, it is increasingly clear that, there are complex dynamics in informal settlements that influence upscaling of sanitation interventions. Isunju *et al.* (2011) for instance point out that in informal settlements, sanitation solutions are not only about creating demand or designing an appropriate technology, but that there are challenges such as insecure land tenure and different needs of landlords and tenants (Isunju *et al.*, 2011). Therefore, apart from estimating costs, willingness to pay, and designing appropriate technologies; decisions have to be made about the uptake of sanitation interventions and proper management of shared sanitation facilities.

Jenkins and Scott (2007) theorised a typology of decision making for sanitation uptake. According to their typology, decision making for sanitation begins with showing preference for sanitation, an intention to adopt or install sanitation facilities, and an actualisation of this preference and intent through the adoption of sanitation facilities. This typology is a novel approach; nonetheless, the decision to install sanitation facilities in informal settlements is challenged by various other factors within the settlements. To begin with, each informal settlement has its own unique living conditions, and other unobserved factors, such as relationships, perceptions and attitudes also explain the choices that individuals make (Santos *et al.*, 2011; Mimmi, 2014). Tenure insecurity often times implies that tenants may not always prioritise investing in basic services (Marx *et al.*, 2013) such as sanitation, and finally, landlords and tenants have different preferences (Isunju *et al.*, 2011), implying that sanitation preferences of tenants may not be the same as the landlords'.

Furthermore, sanitation in informal settlements also faces challenges such as multiple actors who play a role in sanitation provision, a lack of appropriate technologies, a lack of finances, and a lack of end-user engagement during the design of sanitation solutions (Paterson *et al.*, 2007; Lüthi *et al.*, 2011). Such challenges suggest that decision making for sanitation in informal settlements goes beyond the household level, and each stakeholder therefore ought to be involved in decision making. At the household level, the landowners act as sanitation providers, while tenants have a role to play in behaviour that does not deteriorate the quality of sanitation facilities. Households are therefore both suppliers and consumers of sanitation (Okurut *et al.*, 2015). At the community level, there are community based organisations, non-governmental organisations, schools, local leaders and private organisations who are involved in sanitation service provision, awareness, community mobilisation, transportation and emptying of faecal sludge, as well as repair of existing sanitation facilities. The local government is involved in regulation, financing of sanitation, as well as sanitation service provision; while non-governmental organisations are involved in sanitation service provision (Hendriksen *et al.*, 2011; IWA, 2014). Several government ministries such as public health, planning, and environment are usually responsible for planning/policy formulation and financing. The ministry of public health for instance is responsible for health aspects related to lack of sanitation such as prevention measures of sanitation related diseases, the ministry of planning is responsible for the planning of informal settlements, while the ministry of environment is responsible for solid waste management.

Traditional research approaches have not given stakeholder involvement much emphasis, yet it is increasingly becoming clear that their involvement is key. Research approaches such as transdisciplinary (TD) research promotes a thorough understanding of a (complex, real-world) problem by integrating various scientific disciplines and actors linked to a problem into the research process. These various disciplines each bring in different perspectives necessary for problem solving. The different actors may include those in the academic and non-academic sectors, those in government, non-governmental organisations as well as the community members. Integration of these actors should lead to a shared understanding of the problem, the identification of solutions, and the promotion of the common good (Pohl & Hadorn, 2007; Lang *et al.*, 2012). In view of such research approaches, and in appreciation of the sanitation challenges in informal settlements, this study was

aimed at investigating decision making for sanitation in informal settlements. The first objective was to understand decision making at the point of use (decisions made, who makes them and how, and the factors influencing the making of these decisions), and the second was to borrow from the transdisciplinary approach to initiate a decision-making process for sanitation in the informal settlements of Kisumu, Kenya. Before addressing these objectives, the paper will briefly describe the study area and the data collection procedures used to investigate decision making in the informal settlements. The presentation of results will be followed by a discussion and a conclusion, after which implications for policy and research will be provided.

7.3 Study area

Information about the study area is detailed in sections 3.3, and in chapters 4 through 6. In terms of settlement, residents live mainly in compounds (a group of single-unit houses under one landlord), which have a variety of occupiers, such as resident landlords (who do not have tenants living on their compounds), resident landlords who have tenants within their compounds (live-in landlord), as well as landlords who live away from their tenants (absentee landlords).

Due to the highlighted sanitation and developmental challenges in the settlements, there are a number of stakeholders working in the informal settlements, such as governmental organisations, international agencies, NGOs, CBOs, neighbourhood associations and community groups (Huchzermeyer, 2009; Cage, 2014; Letema *et al.*, 2014). The various sanitation challenges mentioned, as well as the variety of stakeholders, were the impetus for a study on decision making for sanitation in the settlements.

7.4 Methods

In order to fully examine decision making, this research was carried out in three stages. The first stage was aimed at understanding decision making at the point of use (compound level), while the second and third stages were to understand and facilitate decision making at the community and city/planning level respectively. Compound and community-level decision making were investigated through interviews and participatory discussions with the residents of the informal settlements, while at the city level, other stakeholders (in addition to community members) were involved in participatory workshops.

7.4.1 Stage one: Decision making at the point of use (compound) level: Interviews with household heads

Details about the clusters where the study was carried out, the sampling process, sample size, respondents and their selection, data collection tools, and data collection methods have been detailed in section 3.5.3.

7.4.2 Stage two: Community-level decision making: Group discussions with community members

After the first stage of data collection, the process of selecting respondents for the second stage of participatory group discussions began. The aim was to triangulate information from the household interviews, as well as to initiate a decision-making process in which community members identified sanitation challenges, as well as appropriate sanitation technologies for their settlements.

Using the findings from the interview stage and from previous phases of data collection, a participant selection criteria was developed, based on residence type (landlord/tenant) and availability of sanitation facilities in a compound. This criterion led to eight categories of participants:

1. Landlords who lack a sanitation facility
2. Landlords from compounds with tenants, and who have a sanitation facility.
3. Landlords from compounds with tenants, and who lack a sanitation facility.
4. Tenants from compounds with live-in landlords, and have a sanitation facility.
5. Tenants from compounds with live-in landlords, who lack a sanitation facility.
6. Tenants of absentee landlords who have a sanitation facility.
7. Tenants of absentee landlords who lack a sanitation facility.
8. Tenants living on compounds with caretakers and have a sanitation facility.

Details about sampling, sampling clusters, the process of selecting respondents, conducting the discussions, as well as number of sessions held have been detailed in section 3.5.3.

7.4.3 Stage three: Policy level decision-making workshops with all stakeholders involved in sanitation in the informal settlements

The aim of the stakeholder workshops was to facilitate a decision-making process for sanitation in the informal settlements by involving all stakeholders. The stakeholders were representatives of development organisations in Kisumu, such as the municipality/local government, non-governmental organisations, academic institutions, government ministries, the local authority, media representatives, community organisations, as well as community members (Table 7.1).

Table 7.1 Organisations represented in the stakeholders' decision-making workshops in Kisumu

Stakeholder	**Type/field of expertise**
Kenya Water and Health Organization (KWAHO)	Water and sanitation
National Environmental Management Authority (NEMA)	Environmental management and regulation
Practical Action	Appropriate technology, energy, sanitation
Kisumu Urban Apostasy Project (KUAP)	Water, sanitation and health
Kisumu Urban Project (KUP)	Upgrading of informal settlements
Sustainable Aid in Africa (SANA)	Water and sanitation
Cord Aid	Water and sanitation
Radio Sahara	Local radio station
Umande Trust	Water, sanitation, energy
Ministry of public health	Sanitation and public health
City manager	Development in Kisumu County
Maseno University	Academic institution
Great Lakes University of Kisumu (GLUK)	Academic institution
City Planning Department	Planning
Manual Pit Latrine Emptiers	Disposal of faecal sludge
Kisumu Water and Sewerage Company (KIWASCO)	Water and sewerage
Ministry of Water	Water
Chiefs	Local authority

The stakeholder selection process began by listing the obvious stakeholders who were involved in sanitation in the informal settlements. The listed stakeholders were visited at their offices, where informal discussions were held and the aims of the workshops were clarified. Through these discussions, other stakeholders who had not been included in the initial list were identified and added to the list. This process of identification and invitation continued until it was felt that all relevant stakeholders had been included. In addition to informal visits, formal invitation letters were also sent to the stakeholders detailing the venue and dates of the workshops. Community leaders were instrumental in identifying and selecting community members, and a selection process similar to the one in the previous stage was carried out. Caution was taken to ensure that selected members were different from those selected in the earlier exercise.

On the day of the workshop, after the participants had arrived at the venue, key stakeholders gave talks on sanitation challenges and their role in improving sanitation in the informal settlements and in the city. After the talks, participants sat together in smaller groups in which they discussed sanitation challenges in the informal settlements and the way forward. Each of the groups had a mix of stakeholders to ensure that each stakeholder's opinion was taken into consideration. After the small group discussions, each of the groups summarised their discussions

to all participants, after which there was a discussion that summarised the key findings with a consensus on the way forward. Two of these stakeholder workshops were held.

7.5 Data management and analysis

Data from the household interviews and group discussions were recorded on audio devices, after which they were transcribed verbatim in Microsoft Word.

The initial analysis of the household interview data as well as the group discussion data, began during data collection, and was done mainly through listening to respondents, analysing body language and words used, and probing to get more information on issues that were not clear. At the end of each day, notes were made about the highlight of the day, and any cases that were 'abnormal' and needed follow up were noted for follow up in subsequent interviews and/or group discussions.

After data collection, each transcript of the interviews and small group discussions was read and re-read to understand the respondent's story in the light of decision making. By reading through the transcripts, a list of emergent codes was developed, and using ATLAS.ti software, the transcripts were coded inductively (using codes that emerged from the transcripts). As new codes emerged, they were added to the list, and each transcript was read again and coded according to the new codes (if applicable). The codes were then grouped into the main emergent themes, which were used to explain the results. These emergent themes were compared against the objective to assess if they were adequate to provide a rich explanation to the objective.

Transcripts from the participatory group discussions and stakeholder workshops were also subjected to a similar iterative process of reading, re-reading, coding and development of themes. The codes were summarised into the main themes and the transcripts were compared over and over to ensure that all codes were grouped into themes and that the themes were a clear summary of the issues discussed during the meetings.

7.6 Results

7.6.1 Sanitation decision making at the point of use: Household interviews

The main respondents were landlords, caretakers and tenants. The tenants lived in compounds with live-in landlords, a caretaker, or with absentee landlords. A few compounds had functional pit latrines, some had pit latrines that were filled up, while others lacked sanitation facilities altogether. Compounds lacked pit latrines because they had collapsed or had never been constructed. Respondents from

compounds that lacked sanitation facilities or compounds with filled up (hence dysfunctional) pit latrines used facilities at neighbouring compounds, with a few admitting to defecating in the open or using plastic bags.

> *"… I go to someone's farm … very early before he wakes up …"*
>
> *"… I use a polythene bag … I put it [the polythene bag with faeces] inside a container, then disguise as someone disposing of normal rubbish…"*

The main themes that emerged were: type of decisions made, the decision-making process, and reasons for the decisions. These themes will be presented according to the type of respondent (landlord or tenant).

Type of decisions made

Tenants and landlords made different decisions. Landlords mainly made decisions on sanitation construction and repair. Live-in landlords made decisions on emptying sanitation facilities, unlike absentee landlords, who were less likely to make decisions on repair. Live-in landlords allowed their tenants to make decisions on cleaning, although some were still involved in making these decisions.

Tenants, on the other hand, rarely made decisions about the construction of sanitation facilities; they reported their need for sanitation construction and repair to their landlords. On few occasions, however, tenants in compounds with absentee landlords made decisions to repair or empty filled-up sanitation facilities. In general, the respondents felt that management decisions such as cleaning sanitation facilities should be made by tenants.

Decision-making process

Decisions were made in three main ways: individually (without consultation), by consulting another individual, or collectively.

Landlords

Live-in landlords made decisions to construct sanitation facilities individually, with little consultation, and without the involvement of tenants.

> *"… I consult no one, not even the tenants, all I do is get the money I need and go ahead with what I need to do… "* [a male landlord]

Other times, landlords consulted or informed their immediate family members, such as spouses or their grown up children, when making decisions to construct or repair

sanitation facilities. One landlady, when asked if she consulted anyone in making decisions such as constructing sanitation facilities in the compounds said:

> *"… I talk to my son … because he helps me make decisions on how to manage the compound …"*

Outside the family unit, landlords made mention of talking to friends and/or neighbours, primarily for advice, and especially when they did not have an immediate family member. They consulted specialists such as masons and pit latrine emptiers to get expert advice, quotations or actual sanitation services. One landlord described the people he consulted when making decisions on sanitation investment by saying:

> *"… I consult my neighbour who has constructed one [a toilet] … then I will talk to the fundi …"* [a male landlord]

Absentee landlords at times allowed their tenants to make decisions after they (tenants) consulted them (landlords). Some absentee landlords showed less concern and left tenants to make all decisions of construction, repair and maintenance.

Tenants

Tenants, on the other hand, had various ways of making decisions, depending on their circumstances. They made decisions at an individual level, by consulting a second party, or collectively. Decisions to construct or repair sanitation facilities were made by consulting or informing the landlord, especially because of monetary implications. Often times, when tenants were directly involved in construction or repair of sanitation facilities, they deducted the cost from their monthly rent. One tenant described how they made a decision to repair their sanitation facility:

> *"… We informed the landlord first … then deducted the costs from our monthly rent …" [A tenant]*

When there was a caretaker, tenants notified him, and he would either make a decision or inform the landlord.

> *"… We informed the caretaker … he rang the landlord, who asked him to repair the toilet …" [A tenant]*

In other instances, concerns originated from one individual tenant, who consulted members of his household and afterwards talked to the landlord. Alternatively, from the household, the matter was discussed with other members within the compound. For example, stay-at-home women noted sanitation concerns and discussed them with their husbands. The issues were then discussed with other compound members, the caretaker or the landlord. A decision would then be made individually

(for instance by the landlord) or collectively, depending on the management structures in place. Tenants described such situations by saying:

> *"… Women told their husbands, who then told the landlord … the landlord decided to empty the latrine …"* [A tenant]

> *"… We had a meeting in the compound … we agreed that everyone would contribute from the rent money …"* [A tenant]

In compounds without management structures or a leader, sometimes one individual raised and discussed sanitation concerns with other compound members, after which they arrived at a solution. A tenant living in a compound with an absentee landlord, and without a toilet described the process she went through to ensure that she and members of her compound could use her neighbour's toilet:

> *"I talked to the landlord in the neighbouring compound … I told him we did not have a toilet in our compound … I asked if we could pay to use his toilet … he agreed … then I talked to my next door neighbour … and then to the other neighbour … and they all agreed…"*

Tenants who lived in compounds with absentee landlords and needed minor repairs to their sanitation facilities sometimes consulted neighbours or friends. These friends or neighbours would do the needed repairs, especially due to good relations between them. Again, such decisions were initiated by an individual or a few compound members. One tenant described how she and other tenants from her compound asked their neighbour to repair their toilet for them because of the good relationship they shared:

> *"… A few of us talked to him because he is our neighbour … we did not need to pay him …"*

Management decisions among tenants were made in a similar fashion. Individuals made voluntary decisions to clean sanitation facilities, especially when there were no cleaning arrangements in place.

> *"… Anyone cleans the toilet … if no one is willing to clean it [the toilet], it will remain dirty …"* [A tenant]

In compounds with proper cleaning arrangements, management decisions were made collectively, often during meetings within the compound. Individuals would then be expected to abide by the decisions that were agreed upon.

In other instances, sanitation concerns were raised by individuals to the leader in the compound, such as the caretaker. The caretaker would then make a decision, organise a meeting with all compound members, or inform the landlord. A tenant explaining this process said:

> *"… If anyone notices a problem, we inform the caretaker. The caretaker informs the landlord who asks him to repair …"*

Again, just like construction and repair decisions, tenants also talked to fellow tenants when making management decisions.

Figures 7.1 and 7.2 summarise a tenant's decision-making process. In summary, tenants in compounds with a leader/caretaker (Figure 7.1) or in compounds with an absentee landlord (Figure 7.2) have several individuals to consult, and the decision-making process can be complex.

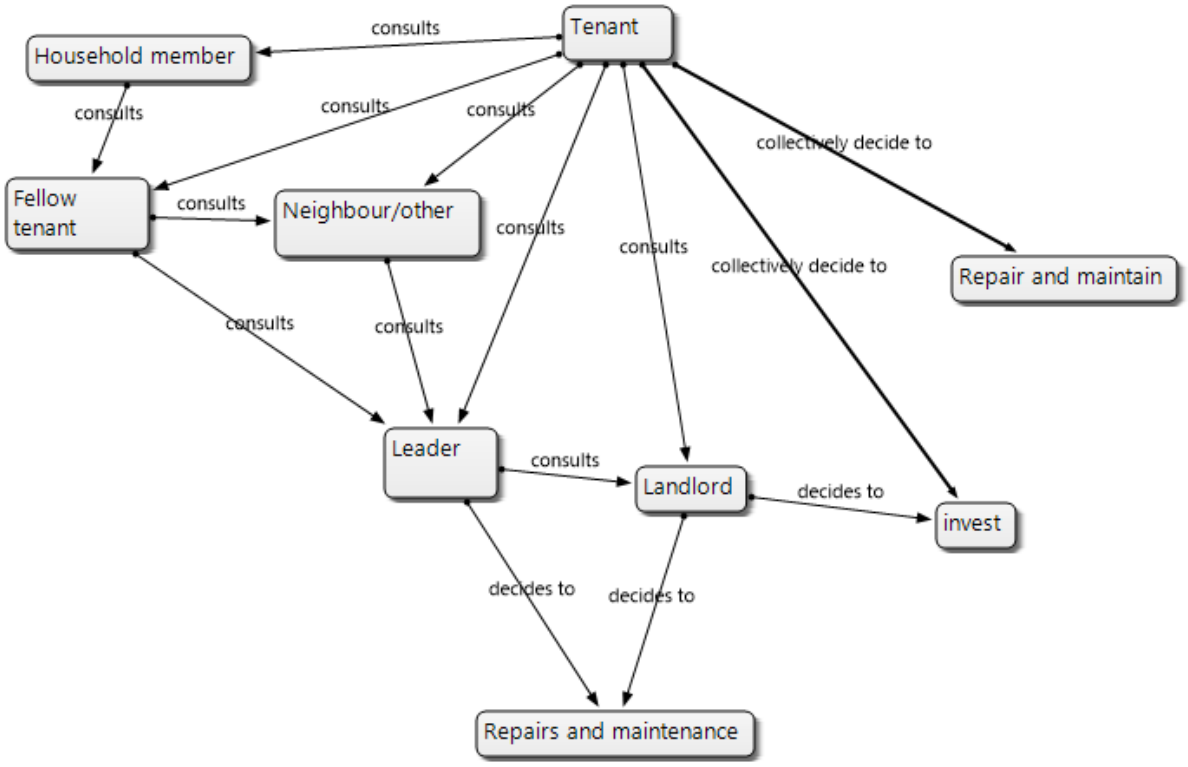

Figure 7.1 Sanitation decision-making process of tenants living in compounds without a landlord but with a leader/caretaker (developed in ATLAS.ti)

Tenants in compounds with live-in landlords do not have such a complex decision-making process, because landlords make most of the decisions. Similarly, live-in landlords do not have a complex decision-making process like that of tenants in compounds without a landlord.

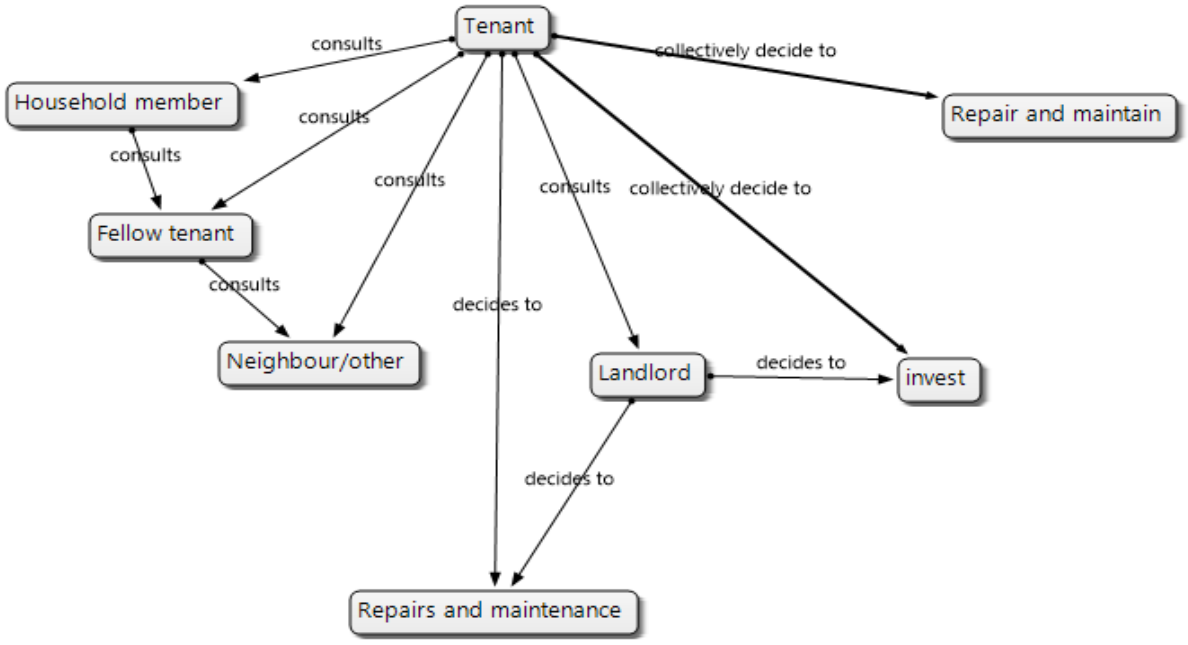

Figure 7.2 Sanitation decision-making process of tenants living in compounds with an absentee landlord (developed in ATLAS.ti)

Reasons for types of decisions made and how they were made

Feeling of responsibility/ownership

Irrespective of whether compounds had sanitation facilities or not, respondents felt that landlords were responsible for the construction of sanitation facilities, because they were owners and hence 'permanent residents', unlike tenants, who were 'temporary' and more likely to relocate to other areas.

> *"This is my home … repairs and construction are none of the tenants' business … it is my responsibility … a tenant can move out anytime because this is not his property."* [A landlord]

> *"I pay rent … construction and repair are the landlord's duty … one day I will move to another place, will I then move with the toilet? Why should I construct or repair?"* [A tenant]

Uncooperative landlords and tenants

Tenants mentioned that landlords took long to respond to their sanitation needs, such as the construction of sanitation facilities or the repair of existing facilities. They also claimed that landlords totally ignored their demands for sanitation, and were rather more concerned about rent. Due to such delays and disregard from landlords, tenants opted to use their rent to cater for sanitation costs such as

construction and/or repairs. Landlords also confirmed that often times, tenants did not agree to directly pay for sanitation because they felt that it was the landlord's responsibility. A landlord expressed his concern by saying:

> *"Tenants are difficult people … they never want to be involved … they say that their duty is only to pay rent."*

In terms of maintenance, individual tenants volunteered to clean sanitation facilities when there were no cleaning structures/plans. On other occasions, even though there were arrangements in place, some tenants did not carry out their cleaning responsibilities, and thus other tenants in the compound volunteered to clean the sanitation facilities. A tenant expressed the situation by saying:

> *"I clean the toilet very often … some neighbours soil it but do not clean. I am forced to clean because I have children who will use the toilet."*

Due to the lack of cooperation in cleaning sanitation facilities, live-in landlords often separated their sanitation facilities from those of tenants. By so doing, landlords would clean their own facilities, leaving tenants to devise their own cleaning and management plans. However, because landlords felt responsible, even with such separation, they still made decisions on management, sometimes instructing tenants to clean, or even cleaning the facilities themselves.

> *"Some tenants do not want to clean the latrine … that is why I decided to have my own separate toilet which I clean myself."* [A live-in landlord]
>
> *"The tenants will not agree to clean the toilet … they say the compound is mine … I therefore just clean the toilet myself."* [A live-in landlord who cleaned the toilets in his compound]

Costs and financial reasons

Despite acknowledging that they were responsible for the construction of sanitation facilities, most landlords who had not done so confessed that they had limited finances. Other landlords constructed sanitation facilities because of financial gains that resulted from compounds that had sanitation facilities.

> *"No one will accept to rent my house if there is no toilet … in order to get tenants, it is better to construct a toilet."*
>
> *"Tenants first ask if there is a toilet … they will not live in a compound without a toilet … I construct a toilet because I do not want to lose tenants."*

Some live-in landlords allowed tenants from neighbouring compounds, who lacked sanitation facilities, to use the sanitation facilities within their compounds. Sometimes this use was based on friendliness or good relations, but most of the time these tenants were required to share the costs of pit latrine emptying. Tenants agreed to such arrangements because they lacked sanitation facilities, and/or their landlords were seemingly reluctant to respond to their needs, which rendered them desperate. In general, tenants contributed between 100 and 250 Kenyan Shillings per household.

> *"We use our neighbour's toilet … when it fills up, we contribute … for emptying."* [A tenant]

Other live-in landlords took advantage of the prevalent lack of sanitation in the settlements to make extra income by asking users to pay per use. One landlady explained that she allows others to use her toilet but required all users to pay:

> *"My toilet is used by people from the kindergarten, my tenants, and people from other compounds who do not have toilets … each of them has to pay before use."*

Some landlords, whether live-in or absentee, who lacked sanitation facilities in their compounds, had agreements with their neighbouring landlords (who had sanitation facilities) to allow their tenants (of landlords without sanitation facilities) to use sanitation facilities in the neighbouring compounds. The landlords without sanitation facilities would then share costs with their neighbouring landlords, often for emptying filled-up latrines.

Living conditions within the informal settlements

A mix of challenging living conditions within the settlements led to landlords and tenants making the mentioned decisions.

Due to the frequent collapse of pit latrines, some landlords living close to each other took turns to construct one pit latrine that was shared by all tenants from their compounds. When the one pit latrine got filled up or collapsed, the next landlord would construct another, and this cycle would continue among the landlords. This system was a strategy to save on the costs of construction, and it worked when there were good relations with the landlords and tenants. One landlord explained it thus:

> *"The soil in this area is not good … we construct a toilet today, and soon after it collapses … we are tired … what we have decided as landlords who have compounds next to one another is that we will be constructing toilets in turns.*

> *For example, the landlord from that compound constructs a toilet this time, and I then do it next time; then our tenants will always have a toilet to use and we will not spend a lot …"*

It also emerged that some landlords gave false promises to their tenants about constructing sanitation facilities. Absentee landlords especially, whose compounds lacked sanitation facilities, asked their tenants to pay their monthly rents in time with the promise that the total amount of their rent would be channelled towards the construction of sanitation facilities. Tenants banked on their landlords' promise, but the landlords did not keep their word.

In an attempt to resolve this, tenants would collectively agree that they would not pay their rent until their landlords constructed sanitation facilities. However, some tenants did not keep their word and still paid their rents to the landlords, making the other tenants appear defiant. Eventually, all tenants then ended up paying, and thus they remained without sanitation facilities in their compounds.

Landlords, on the other hand, took advantage of the situation and asked tenants who refused to pay rent to vacate their premises, knowing that they would get other tenants who would be willing to take up the vacant houses.

> *"If there is anyone who is not willing to pay rent, I ask them to leave so that a willing tenant can move in and occupy the house …"* [A landlord]

However, some landlords admitted that they did this in a subtle way (because they knew that they were required to provide sanitation facilities).

> *"They* [tenants] *can decide to report to the chief … if this happens, the compound can be closed … so we find a way of talking to them so that they pay …"*

In this complex situation, tenants had to choose between moving to other compounds that had sanitation facilities and living in their current compounds that lacked sanitation facilities. Some tenants moved to compounds with sanitation facilities, but others continued living in the compounds without sanitation facilities. These tenants who did not move admitted that they lingered at their compounds because of the scarcity of housing, financial challenges, proximity to services and, sometimes, good relations with their landlords.

> *"We talked to the landlord … he told us to vacate … finding houses is a challenge, so we are forced to stay on …"*
>
> *"We cannot vacate this place because it is safe and is close to the road …"*

> *"We are forced to stay because the landlord understands when I do not pay my rent in time … in other compounds they may not be as understanding …"*

When tenants made the decision to live in compounds without sanitation facilities, they sought for alternative solutions such as facilities in neighbouring compounds.

Effect of land inheritance and absenteeism

A number of landlords inherited their compounds from their late parents or grandparents, but since these landlords lived elsewhere, they rented out the premises within the compounds they inherited (thereby becoming absentee landlords). These absentee landlords showed little responsibility for their compounds, to the extent that most of their compounds lacked sanitation facilities. Some rarely went back to check on their compounds, but rather asked their tenants to pay rent via mobile money transfer.

Such absentee landlords rented out their premises to people they knew, or in other instances the tenants had lived within the premises long enough that they had developed trust or friendship with the landlord. Based on this friendship and the apparent lack of concern from the absentee landlords, tenants took advantage and did not pay up their rent in good time, or did not even pay rent at all. Landlords, on the other hand, because of delays in rent payment, did not make any improvements to the housing units or to the sanitation facilities (if there were any). In such circumstances, tenants continued living in compounds without sanitation facilities because of the low costs of living, subsequently finding alternatives for their sanitation needs, such as neighbouring compounds.

7.6.2 Decision making 2: Participatory discussions at the community level

Participants in the group discussions mentioned various challenges facing sanitation in the informal settlements. They also identified a number of sanitation technologies that they knew of, giving reasons for or against the feasibility of these technologies in the settlements.

Sanitation challenges in the informal settlements

1. Ignorance

Community members lacked knowledge of proper hygienic practices and the effects of not practising proper hygiene and waste disposal. It was also evident that residents lacked knowledge of alternative sanitation technologies.

2. Environmental challenges

Respondents acknowledged that some areas within their settlements had a high water table and loose soil, thus pit latrines would fill up with water during the rainy season, which led to their easy collapse.

3. Lack of a reliable water supply and sewer system

Although access to water had improved in most areas in the settlements, residents noted that the water supply was unreliable since they still experienced water shortages.

"… Water is a problem in this area, sometimes it is not available …"

Coupled with a lack of water was the lack of a sewer system in the settlements, thereby limiting the types of sanitation technologies that could be installed.

4. Poor state of available sanitation facilities

Sanitation facilities within the settlements were in poor conditions. Most of them were filled up, others were poorly constructed and needed repair, and others were not hygienically clean. As a result of poor construction and the environmental challenges, most of the pit latrines did not provide privacy, and they also collapsed easily.

5. Sharing sanitation facilities and poor management

Most sanitation facilities were shared among members in a compound. Some compounds lacked clear sanitation management structures, while in other compounds some users did not carry out their cleaning responsibilities even when there were structures in place. As a result, pit latrines were often dirty and unpleasant to use.

6. High population density and congestion

The respondents felt that the settlements were congested, and some compounds did not have any space to construct sanitation facilities. Congestion also hindered the viability of a sewer line, hence most sanitation facilities were pit latrines that filled up fast because of the high number of users. Due to congestion, municipal trucks that empty pit latrines could not access some areas in the settlements. To deal with this challenge, residents employed the services of manual pit latrine emptiers to empty full pit latrines.

7. Poor waste disposal

Due to the lack of sanitation facilities and dirty or filled-up latrines, residents resorted to using other alternatives, such as open defecation or polythene bags for human waste disposal. These actions posed a great public health risk, especially to children. In addition, though some manual pit latrine emptiers disposed of the contents from pit latrines by burying, others disposed of them in open trenches to be washed off by rain water, which posed a health and environmental risk.

8. Financial challenges

Landlords who lacked sanitation facilities admitted that, apart from environmental challenges, they were also limited by finances, hence could not afford to construct sanitation facilities. On the other hand, residents preferred employing the services of manual pit latrine emptiers because they were affordable compared to the municipality trucks[18], even though these manual emptiers sometimes did not dispose of the sludge correctly.

9. Insecurity

Residents were concerned about general insecurity in the settlement, which was also a concern to sanitation facilities. Due to the general lack of sanitation facilities in most compounds, some compounds locked their sanitation facilities with padlocks to keep intruders from using them. However, some intruders, who would often be residents from compounds without sanitation facilities, would still break open the latrines and steal the padlocks, and sometimes also the construction materials such as iron sheets.

10. Conflict between landlords and tenants

Landlords blamed tenants for not paying rent in time and for being irresponsible in sanitation management. They felt that tenants contributed to the frequent fill-up of pit latrines because they disposed of other waste materials such as diapers, stones or pieces of cloth in the pits. Tenants, on the other hand, blamed the landlords for showing less concern and not providing sanitation facilities.

[18] The manual pit latrine emptiers charged approximately KES 3 000 for emptying. The municipal truck charged approximately twice this amount.

Identified sanitation technologies in the informal settlements

The participants deliberated on types of sanitation technologies and their feasibility in the informal settlements. In most of the categories, the participants felt that the pit latrine was the most feasible technology, despite the challenges associated with it (Table 7.2). Most residents lacked knowledge of ecological sanitation (EcoSan[19]) technologies, except landlords who lived in areas where it had been introduced. These landlords preferred EcoSan because they could use the resultant manure on their farms. However, many respondents felt that EcoSan was not appropriate because it filled up fast and required frequent emptying. The flush toilet, though desired, was discredited because of a lack of sewer system and unreliable water supply.

Table 7.2 Summary of feasible sanitation technologies, according to residents of Kisumu's informal settlements

Category of respondents	**Most feasible**	**Second option**	**Third option**
Resident landlords with tenants, but lacking a sanitation facility	Pit latrine	Flush toilet	EcoSan
Resident landlords with tenants, with a sanitation facility	Pit latrine	EcoSan	Flush toilet
Landlords without a sanitation facility	EcoSan	Pit latrine	Flush toilet
Tenants with resident landlords, and with a sanitation facility	Pit latrine	Flush toilet	EcoSan
Tenants with resident landlords, but lacking a sanitation facility	Pit latrine	EcoSan	Flush toilet
Tenants with absentee landlords, and with a sanitation facility	Pit latrine	Flush toilet	EcoSan
Tenants with absentee landlords, and lacking a sanitation facility	Pit latrine	Pour flush	EcoSan*
Tenants living on compounds with caretakers, and with a sanitation facility	Pit latrine	EcoSan	Flush toilet

* They ranked the flush toilet as the fourth option
Source: Community participatory group discussions

7.6.3 Decision making 3: All stakeholders

In both workshops, the attendees reiterated the sanitation challenges facing the informal settlements that had been raised during the group discussions. In addition to costs and the lack of a reliable water supply, it was mentioned that high water tables increased the risk of water contamination from pit latrines, while the unplanned nature of the settlements and the high rate of urbanisation limited the feasibility of a sewer connection.

[19] A type of toilet, usually raised from the ground, where urine and feces are collected into separate containers. The urine is usually poured off, but the feces can be used as manure in agriculture

It was again reiterated that residents in the informal settlements were ignorant about sanitation and hygiene practices. Landlords were ignorant of latrine construction guidelines, while tenants were ignorant of their right to sanitation. Concerns were also raised about the health and safety of the manual pit latrine emptiers, and the municipality's lack of modern emptying technologies. Compared to the water sector, it was highlighted that the sanitation sector was underfunded.

As a way forward for sustainable sanitation, the participants recommended four main strategies:

Sanitation awareness and demand creation

There was a need to raise awareness on the importance of sanitation, proper hygiene practices, and the individual right to sanitation. Awareness creation could be done through individual efforts, community forums, local leaders, community groups and the media. Once awareness had been created, it would be possible for residents in the settlements to change their attitudes.

Budgeting, policies and regulations

The participants noted that there was a need to develop a budget for the informal settlements and to allocate resources towards it. There also was a need for clear feedback from the community level to the policy-making level, both on priorities for and expenditure on sanitation. Sanitation policies and regulations needed to be developed, revised and enforced.

Appropriate sanitation technologies

The existing sanitation technologies needed to be reviewed, and research on appropriate technologies conducted. Sanitation technologies for the informal settlements ought to be those that can be constructed locally, and are appropriate and affordable.

Sustainable and participatory management

The participants emphasised the importance of involving stakeholders in all stages of sanitation improvement. Stakeholders such as NGOs, CBOs, the ministries of agriculture, health and energy, the National Environment Management Authority (NEMA), Kisumu Water and Sanitation Company (KIWASCO), local churches and local community gatekeepers (neighbourhood associations) should be actively involved, thereby encouraging partnerships. The local pit latrine emptiers needed to

be recognised, trained and empowered. Women ought not to be excluded from the partnerships. These challenges and possible solutions have been summarised in Table 7.3.

Table 7.3 Summary of Kisumu informal settlements' sanitation challenges and possible solutions

Challenges	**Possible solutions**
Environmental challenges – high water table and loose soil	Appropriate sanitation technologies
Lack of reliable water supply	Sustainable management, budgeting
Lack of a sewer system	Sustainable management, budgeting
Poor condition of existing sanitation facilities	Awareness and demand creation
High population density, frequent fill-up of latrines, inaccessibility by municipal trucks	Sustainable management, appropriate technologies
Sharing sanitation facilities and poor management	Awareness and demand creation
Poor waste disposal, including human waste	Awareness and demand creation
Financial challenges	Awareness and demand creation, appropriate sanitation technologies, budgeting
Insecurity	Budgeting, policies and regulations
Conflict between landlords and tenants	Regulations, awareness and demand creation

Source: Summarised from community participatory meetings and stakeholder workshops

7.7 Discussion

As demonstrated in this study, decision making for sanitation occurs at several levels, from the basic level at the point of use (household), to higher levels (city, national or higher).

7.7.1 Decision making at the 'point of use'

Due to the lack of space for household facilities in most informal settlements, sanitation facilities are often shared, either among a number of households or as communal facilities. Reference to 'point of use' in this study is made to denote the use of sanitation facilities at the compound level, where several households share sanitation facilities. Sanitation decisions at the point of use include investment in, repair and maintenance (including emptying) of shared sanitation facilities. These different decisions are made by different individuals, due to a number of reasons.

One of these reasons is the lack of sanitation services in informal settlements, which means that the responsibility of provision is often upon the landowners (Isunju *et al.*, 2013), while tenants have little control and rarely make decisions on investment

in sanitation (Jenkins & Scott, 2007; O'Keefe, Messmer, *et al.*, 2015). Similar experiences have been reported from informal settlements in Nairobi and Kampala, where landlords often took up the responsibility of constructing/providing sanitation facilities (O'Keefe, Lüthi, *et al.*, 2015).

However, as indicated by the results of this study, not all landlords take up the responsibility of providing sanitation facilities. Live-in landlords were more likely to invest in sanitation facilities compared to absentee landlords. Live-in landlords made decisions to invest in sanitation as though it was their household sanitation facility, because they were property owners and also because of the financial gains of constructing sanitation facilities (Chapter 5). These live-in landlords also made sanitation investment decisions individually or by consulting within the household, a finding that resonates with studies from Ghana, where Nimoh and Poku (2014) show that decisions on investment in sanitation require discussion with at least a spouse or another family member.

Apart from investment decisions, results of the present study indicate that repair and emptying of sanitation facilities were viewed as the landlord's responsibility, but not all landlords were fully involved. Absentee landlords were less involved in pit latrine repair and emptying decisions. Live-in landlords on the other hand made decisions on (and paid for) sanitation repair and emptying. The same practice is portrayed by live-in landlords in the informal settlements of Kampala and Dar es Salaam (Isunju *et al.*, 2013) as well as Dakar (Scott *et al.*, 2013). On few occasions, decisions on (and payment for) the repair and emptying of sanitation facilities were made by both landlords and tenants, as it was the case in Tanzania (Jenkins *et al.*, 2015) and Senegal (Scott *et al.*, 2013). Thus, it is clear that landlords mainly make decisions of investment in and repair of sanitation facilities and, in some instances, on maintenance (cleaning).

Tenants in compounds with responsible live-in landlords were at an advantage because they more often had sanitation facilities and did not have to contend with a complex decision-making process. However, when landlords were absent or uncooperative, tenants occasionally made decisions on repair and investment, similarly reported by O'Keefe, Lüthi *et al.* (2015). When landlords failed to provide sanitation facilities, tenants suffered from the effects of a lack of sanitation because they (tenants) were reluctant to invest in sanitation due to their temporary nature. Tenants, therefore, relied on landlords to provide sanitation facilities, but when they were not provided, they opted to use their rent to construct or repair sanitation

facilities. In many cases, they sought for alternatives from their neighbours, even if they had to pay for the service. These findings point to the complex socio-economic dynamics faced by tenants in informal settlements. It appears that a lack and inadequacy of sanitation in informal settlements is not always due to a lack of finances, but could also be due to individuals not taking up their roles as required (some of these issues were highlighted in Chapters 5 and 6).

Apart from differences in the persons who made sanitation decisions, it also emerged from this study that sanitation decisions were made differently by landlords and tenants. Whereas landlords rarely consulted tenants, tenants directly informed landlords of their sanitation concerns, or consulted middlemen such as a caretaker, fellow tenants or neighbours. Neighbours and experts were consulted for advice, be it specialised or otherwise. Findings from Tanzania also show that compared to landlords, tenants always consult in decision making for sanitation. Milanesi's (2010) study in Tanzania revealed that when asked and given time to make decisions on sanitation investment, 50% of tenants consulted other compound members compared to only 4.5% of owners who consulted other members in the compound. From the informal settlements of Kisumu, Tsinda *et al.* (2015) also reported that households asked for sanitation advice from shop owners, local pit latrine emptiers, and masons and that individuals market the services of these local experts through referral or word of mouth.

Such results point to the importance of third parties who influence decision making for the purchase of sanitation technologies, especially if they are new to residents. The presence of a third party is a pointer that individuals are likely to invest in sanitation technologies because they have seen them at friends, or have received recommendations about them. The influence of third parties is also implied by Shakya *et al* (2015) whose results from the rural India reveal that the adoption of latrines is likely to spread from person to person because individuals were more likely to own latrines if their social contacts also owned latrines. However, for the sake of sanitation marketing, Ramani, SadreGhazi and Duysters (2012) warn that poor households may not take up sanitation innovations because they may not perceive them as needs that give instant gratification, or they may not increase income-generating capacities. Although these findings are from a rural setup in India, which may differ from informal settlements in urban areas, they still highlight the significance of a third-party in influencing decision making for sanitation. The underlying principle, as reiterated by O'Keefe, Messmer *et al.* (2015), is that decisions

of investment in sanitation are rarely made by a single person, and often will involve household members and sometimes external persons (Figures 7.1 and 7.2). Quantitative studies and economic models therefore may not always present the reality as it is if they do not include some of these socio-economic dynamics. Milanesi (2010) similarly arrives at such a conclusion from a WTP study in Tanzania and highlights that important outcomes can emerge from an approach that combines one or two economic branches.

Apart from investment in sanitation, the maintenance of shared sanitation facilities is critical and, as evidenced in this study as well as others (Isunju *et al.*, 2013; Tumwebaze *et al.*, 2014; Satterthwaite *et al.*, 2015), cleaning decisions were usually made by tenants. Such decisions were made collectively by all users because sanitation facilities were shared. Collective decision making worked best when there were structures that favoured collective decision making, such as the presence of leaders within the compound. The leader ensured that all users were involved so that everyone could harness the benefits of well-maintained sanitation facilities. The collective benefits that accrue from collective action lead to McGranahan (2015) advocating for collective decision making in sanitation at all levels, from the household, community, and government level, as this can lead to the desired change. If users are not involved, they are likely to make decisions that lead to maximum individual benefit, as opposed to benefits for all users. The desire to maximise benefits, for example, is the reason why some tenants did not clean sanitation facilities, but rather left the responsibility to the few individuals who volunteered to do so (as discussed in Chapter 6). The benefits of including all users in decision making are also implied by Tumwebaze and Mosler (2015) in their study in the informal settlements of Kampala. Though this study noted that having group discussions and making commitment improved the behaviour of cleaning shared facilities, it can also be projected that these group discussions are another form of collectively making decisions. Caregivers, who bear the brunt of inadequate or a lack of sanitation facilities, could be positive agents of change, as rightly pointed out in the stakeholders' workshops.

In addition to decisions made and how they were made, this study also highlighted factors leading to the differences in the decisions made. Finances influenced sanitation investment decisions, either positively or negatively. In this and in other studies (Jenkins & Scott, 2007; Nimoh & Poku, 2014; Okurut & Charles, 2014), a lack of finance was noted as a reason for the non-adoption or lack of sanitation

facilities. Some authors suggest that micro-finance from financial institutions can be a solution (Isunju *et al.*, 2013) while other studies suggest otherwise. In Ghana, for instance, households prefer to use their own funds to build their latrines (Nimoh & Poku, 2014) as opposed to approaching micro-finance institutions. In one of Dar es Salaam's (Tanzania) informal settlements, Kasala *et al.* (2016) report that households could access loans for the construction of sanitation facilities from a local community group although this loan was in the form of construction materials and was payable with interest within 18 months. Such results only suggest that local conditions need to be understood and that appropriate financing mechanisms should be established (as discussed in Chapter 4).

On the other hand, finances can have a positive influence on investment in sanitation. As illustrated in this study and another from informal settlements in Kampala and Dar es Salaam (Isunju *et al.*, 2013), even though tenants may demand sanitation facilities, landlords may be more concerned about the financial benefits from their housing units and not sanitation facilities per se. A context with high demand for housing and low provision of sanitation facilities (as is the case in Kisumu's informal settlements) presents an opportunity for landlords to make financial gains (as noted in Chapter 5) by asking tenants to vacate if they cannot do without sanitation facilities. Other landlords then allow the lacking tenants to use their sanitation facilities, albeit at a cost. Due to poverty or other social reasons, tenants may be forced to silence their demands for sanitation due to their inability to also pay for housing. As such, it becomes an intertwined web of socio-economic dynamics that affect decision making for (or against) investment in, and the repair and maintenance of, sanitation facilities. Such a dilemma is rightly highlighted by O'Keefe, Messmer *et al.* (2015), who remark that the decisions of residents of informal settlements are 'constrained'. They are constrained because of the various socio-economic dynamics that influence sanitation in the settlements.

7.7.2 Sanitation decision making beyond the household level/point of use

The provision of sanitation in informal settlements often is a private responsibility, yet its administration is in the public domain (Isunju *et al.*, 2011). The fact that sanitation cuts across the public and private domains is proof that there are more stakeholders in sanitation provision and maintenance beyond the household, and they have a crucial role to play in decision making. It therefore is worthwhile to involve all these stakeholders in decision making, including the community who are the end users, as well as others like the regulators, municipalities, universities,

government ministries and non-governmental organisations (Kennedy-Walker *et al.*, 2015). The regulators define and enforce laws for sanitation provision. Government ministries such as public health department are regulators, municipalities are involved in ensuring delivery of services such as solid waste management, NGOs are involved in service delivery, and universities can be centres of research that generate new knowledge and technologies for solving local problems. Informal small scale providers also offer sanitation services and products at the community level (Tukahirwa *et al.*, 2013; O'Keefe, Lüthi, *et al.*, 2015; Tsinda *et al.*, 2015).

This study highlighted the community's lack of knowledge of other sanitation technologies. This lack of knowledge was also reiterated in the stakeholder workshops, and has been highlighted by Tsinda *et al.* (2015), who recommend the need for empowering the residents of Kisumu's informal settlements with knowledge that will result in behaviour change and demand creation. To illustrate this apparent lack of knowledge, participants in the community participatory groups recommended the pit latrine as the most feasible and preferred sanitation technology. However, using a socio-technical evaluation framework to evaluate the feasibility of sanitation technologies, Malekpour *et al.* (2013) point out that pit latrines are not feasible in Nyalenda because the black cotton soil prohibits the construction of facilities that rely on soil infiltration. Residents rightly mentioned the challenges faced with pit latrines, but still preferred them over other technologies. The reason is partly because they lacked knowledge of other technologies, and partly because of challenges in the settlements, such as a lack of reliable water supply and sewer system, which limit the feasibility of other technologies that they were aware of.

The challenges mentioned in the community participatory meetings were also mentioned in the stakeholder workshops, which led to discussions among the various stakeholders on possible solutions. The aim of the discussions was to initiate a decision-making process collectively among the various stakeholders involved in the settlements, as opposed to stakeholders not working together. This principle of involving stakeholders is borrowed from the transdisciplinary approach, which encourages the involvement of stakeholders to initiate action that results in the creation of relevant knowledge and solutions (Pohl & Hadorn, 2007; Carew & Wickson, 2010; Pohl, 2011; Augsburg, 2014; McGregor, 2014). These stakeholders from different disciplines including academia, community, governmental and non-governmental usually begin by defining the problem together, then engage in collaborative research that leads to co-production of knowledge that is aimed at a

solution, and is applicable both scientifically and in practice (Pohl & Hadorn, 2007; Jahn *et al.*, 2012; Lang *et al.*, 2012; Darbellay, 2015).

Hendriksen *et al.* (2011) also use this transdisciplinary principle of involving multiple stakeholders in decision making to identify appropriate sanitation solutions for informal settlements in Kampala. They refer to the modernised mixtures approach, which calls for the inclusion and integration of views and contributions from all relevant stakeholders. Through this integration, technical and social scientific knowledge lead to a 'fit' between sanitation options and prevailing conditions (Hendriksen *et al.*, 2011). In the present study, the benefits were evident after the participatory discussions: stakeholders were enlightened, ideas were shared, participants felt part and parcel of the solutions, partnerships were formed, and stakeholders defined their roles in sanitation provision and maintenance. Many community members, for instance, were enlightened about the roles played by various stakeholders and the need to be agents of change in their settlements. There was progress, since the need for change was created and the rest was a matter of time and follow up.

In terms of progress, according to Pohl (2011), since transdisciplinary research is always evolving, pointers of progress include a better approach to the problem and progress in thinking among the stakeholders. Transdisciplinary research places emphasis on group functions and dynamics within teams (Augsburg, 2014), and the involvement of other stakeholders leads to the co-production of knowledge that is practical and applicable in both the real and the scientific worlds (Polk, 2015; Rosendahl *et al.*, 2015), and is part of everyone who created it (McGregor, 2014). Progress was evident in the knowledge that was co-produced and the feeling of ownership among the stakeholders as a result of participating in the knowledge co-production process. Apart from the co-production of knowledge, the involvement of stakeholders such as local community groups leads to the identification of avenues that can be used for improvement. For instance, financial resources can be provided to households through local community groups. These community groups can then provide loans to residents for the construction of sanitation facilities and ensure that the loans are repaid within the stipulated time period. As noted in Brazil, such participatory decision making leads to the identification of tailored solutions in complex situations (Pimentel Walker, 2016).

Finally, the workshops also highlighted that decisions on sanitation in informal settlements are influenced by factors beyond the settlements. For instance, there

was a need for policy enforcement as well as adequate financing for sanitation. Workshop participants further reiterated the importance of having partnerships and the involvement of all stakeholders for the common good. Kennedy-Walker *et al.* (2015) used similar principles to investigate decision making for sanitation within the household, community and the city in Zambia. They highlight the lack of clarity on sanitation roles in key institutions, the lack of support at the community level which, meant that communities lacked appropriate skills and knowledge, and lots of political interference. These findings are similar to the situation in the informal settlements of Kisumu, and just like the suggestions from the workshops, there is a need for all stakeholders to be engaged in all planning and implementation processes (Kennedy-Walker *et al.*, 2015).

7.8 Conclusion

This study has demonstrated that, in informal settlements, decision making for sanitation is more complex than it appears. At a household level there are various individuals involved who, for a number of reasons, make various decisions. Landlords, who primarily are providers of sanitation facilities, make decisions on investment, and their decisions have an impact on tenants, who often make sanitation management/maintenance decisions. Absentee landlords are less likely to be involved in decision making, and tenants have to devise means of dealing with such challenges. Since sanitation facilities in informal settlements are shared, decision making for sanitation is beyond the confines of a single individual or household. Apart from landlords and tenants, other stakeholders should also be involved in decision making, and this study has demonstrated that adequate involvement of all stakeholders leads to the co-production of knowledge that is owned by all, and is beneficial to all. Sanitation decisions, therefore, ought not to be for self-interest, but for the common good.

7.9 Implications and recommendations

What these results suggest is that for urban development, sanitation interventions need to involve both landlords and tenants. These interventions should include aspects of investment-for residents without sanitation facilities, as well as management, for residents who have sanitation facilities. Interventions on investment should primarily target landlords while those of management should be geared towards tenants. These interventions should also include aspects of cooperation that encourage landlords and tenants to work together to clearly define their roles and responsibilities. Municipal officials need to ensure that landlords are

empowered to provide sanitation facilities, especially where the municipality is inefficient. It is indicative that sanitation can be used as an avenue for change, therefore development efforts should target influential individuals in the settlements who can promote behaviour change and whom residents can learn from.

For further research, this study can be used as an initial study to investigate how co-produced knowledge may lead to transformative knowledge.

CHAPTER 8: SUMMARY AND CONCLUSION

8.1 Introduction

This final chapter of the dissertation provides a summary and conclusions of the study based on the objectives that were spelled out in Chapter 1, it makes recommendations for further studies, and outlines policy recommendations as well as the contributions of the study.

8.2 Summary

The main aim of this study was to investigate the socio-economic dynamics of sanitation in informal settlements in Kisumu city in Kenya. Although there were indications of inadequate sanitation in the settlements, there was little (if any) information relating socio-economic dynamics to a lack, or the management of sanitation in these settlements. The study began with a quantitative study (cross-sectional survey), which was followed by qualitative studies (case studies and participatory research) in an explanatory sequential mixed methods design. The chapters in this dissertation have highlighted some of these socio-economic dynamics, often at the household level, which affects access to and management of sanitation in Kisumu's informal settlements. A number of conclusions relating to the objectives can be drawn from the findings.

8.3 Conclusion

This study aimed to answer four main objectives:

- To describe living conditions in the informal settlements of Kisumu.
- To estimate the cost of/payment for sanitation as reflected through house rental prices in Kisumu's informal settlements.
- To investigate the socio-economic determinants of shared sanitation quality in the informal settlements.
- To investigate decision making for sanitation in Kisumu's informal settlements.

The empirical findings on each of these objectives were summarised in Chapters 4 through 7. This section will synthesise these findings, which answered the stated research objectives.

In Chapter 4 the dissertation highlighted the findings on living conditions in Kisumu's informal settlements. The assessment was done by focusing on neighbourhood conditions, compound conditions, land tenure and housing

conditions. The results showed that households in Kisumu's informal settlements have poor conditions at the compound level, where basic services such as sanitation are provided. Though landlords have some tenure security, this security has not motivated them to improve conditions at the compound level such as housing and provision of basic services such as sanitation. Tenants with absentee landlords in particular had poor living conditions. The findings pointed to the provision of basic infrastructural services as an entry point for improvement. The findings also highlighted that there may be opportunities for improvement in the settlements, and there is need to involve all stakeholders, including governmental, non-governmental, community based groups as well as landlords and tenants in the provision of infrastructural services and improvement of living conditions.

With the focus on infrastructure and service provision at the compound level as an avenue for improvement, Chapter 5 focused particularly on the financing and economics of sanitation in informal settlements using a hedonic approach. Having highlighted in Chapter 4 that some housing units attract higher rent than others, the findings revealed that residents living in housing units that are in compounds with sanitation facilities paid significantly higher amounts of rent than their counterparts without sanitation facilities. Availability of sanitation facilities led to a 54% increase in house rental prices, although residents' willingness to pay a higher amount of rent reduced with an increase in the number of households sharing sanitation facilities. The findings further highlight the significance of factors such as education, preferences among landlords and tenants, and absenteeism among landlords. The study noted that other factors, such as norms and relationships, also determine willingness to pay, even though they may not be easily and directly measured by economic models.

To further investigate the reliance on measurable factors and models, Chapter 6 investigated the management of sanitation facilities. As it had been established in Chapters 4 and 5 that sanitation facilities were shared, this chapter took a step further to investigate the socio-economic dynamics of sharing sanitation in informal settlements. The study established that sanitation facilities were shared by an average of eight families, and most of these facilities (64%) were not kept clean. The facilities were more likely to be dirty as the number of users increased. The quality of shared sanitation facilities, however, is not determined by number of users or hardware aspects (such as construction materials) only. The actions and behaviour of users are equally important determinants. The study adopted the common-pool

resource management principles to further investigate determinants of quality. The results reveal that shared sanitation facilities were likely to be kept clean if boundaries and management structures are defined, all users cooperate, and there is collective decision making. An environment with such conditions enables the development of good relationships as well as social norms, which also play a role in influencing the quality of shared sanitation facilities. The determinants of quality of shared sanitation facilities therefore are not in one individual's actions or efforts, but in the collective actions of users.

Following from this finding of group behaviour and action, Chapter 7, in answering the fourth and final objective, highlighted that decision making for sanitation in informal settlements is done at various levels and by various individuals. At the household level, sanitation decisions are mainly on construction/investment or management (e.g. cleaning and pit latrine emptying). Landlords primarily make investment decisions, while tenants are more often decision makers in management aspects (such as cleaning). The findings also show that, with tenants, there often is a third party who is consulted in making most of these sanitation decisions, such as a family member, a neighbour, a caretaker, or a skilled individual. These findings were summarised in diagrammatic illustrations that depicted scenarios of household-level sanitation decision making. Beyond the household level, sanitation decisions are also made at the community level and city level, and this study facilitated a decision-making process that led to stakeholders identifying sanitation challenges in the settlements, appropriate sanitation technologies, as well as ways of addressing the identified challenges. The chapter demonstrated that the adequate involvement of all stakeholders leads to co-production of knowledge that is critical for improvement.

To sum up, the chapters of this dissertation have revealed the complexity of sanitation in informal settlements. Although sanitation is needed and desired by the residents in the settlements, the socio-economic dynamics in the settlements make improved sanitation unavailable for all. Nevertheless, the dissertation has shed light on possible approaches that can be pursued to make sanitation available to most residents in the near future.

8.4 Theoretical implications

This dissertation drew from various theoretical discourses, including development in urban areas and informal settlements, with particular reference to sanitation. The

findings have demonstrated that unlike previous development approaches that focused on economic growth only, development efforts should also embrace the important role played by informal settlements in urban development, such as providing shelter to the growing urban population. Their occurrence thus should not be seen as an eyesore, but rather as an opportunity for improvement – a stance taken by various authors who advocate for the improvement of informal settlements (Nuissl & Heinrichs, 2013; Andersen, 2014; Turok, 2014). Specifically, the study revealed that tenure security is not enough to improve living conditions, and that there is need to invest in infrastructural services. Improvement efforts should therefore identify the positive aspects of informal settlements, as well as the wealth of resources contained therein.

The dissertation focused on sanitation, as global statistics show that its MDG target was not met. A number of sanitation challenges were highlighted in the literature review, and the empirical findings of this study have directly or indirectly shown how these challenges are inter-related. This study has demonstrated that in most informal settlements, solutions require a coordinated involvement of stakeholders, including the residents themselves (Lüthi *et al.*, 2010; Tukahirwa *et al.*, 2013; Kennedy-Walker *et al.*, 2015). Residents are reservoirs of local knowledge and should be involved as stakeholders in decision making for sanitation. These stakeholders cannot work independently because neither one is wholly equipped to address sanitation challenges; rather, they should work collectively, within their strengths. Approaches such as the transdisciplinary approach, which lead to knowledge co-production and the ownership of the implemented solutions (Polk, 2015; Rosendahl *et al.*, 2015), therefore are useful in informal settlements. Co-production, which also entails active stakeholder participation, has been recommended as a possible approach to sanitation improvement (Mitlin & Patel, 2014; Swilling, 2014, 2015; Banana, Chikoti, *et al.*, 2015; Banana, Chitekwe-Biti, *et al.*, 2015; Mcgranahan, 2015; Mitlin, 2015; Satterthwaite *et al.*, 2015).

Aside from improvement efforts that entail sanitation access, this study has also provided important information on sanitation dynamics in informal settlements, which are areas in which the JMP has admitted that statistics are lacking (UNICEF & WHO, 2015). Though most global statistics report on access to sanitation, this study has demonstrated that access to sanitation facilities in informal settlements does not always equate to use of the same. Sanitation facilities in informal settlements are often shared and, as other studies have demonstrated, shared

facilities are often not hygienically clean (Günther *et al.*, 2012; Tumwebaze, 2013; Tumwebaze *et al.*, 2013). Therefore, an improvement of sanitation in informal settlements is not just about the provision of sanitation facilities; efforts should move beyond the hardware aspects and consider the software aspects, such as behavioural dynamics (Okurut *et al.*, 2015). Just as in the case of the provision of sanitation, which requires cooperation from all stakeholders, the sustained use of shared facilities also requires cooperation from all users. Engaging these stakeholders requires more than a single disciplinary approach. This dissertation has for example demonstrated that sanitation cuts across disciplines such as economics, public health, management, engineering, as well as the social sciences.

Finally, to decipher the socio-economic dynamics of sanitation, the study has made use of economic schools of thought to study sanitation in informal settlements. The findings show the inadequacy of the neoclassical discourse in investigating payment and decision making for sanitation in informal settlements. Neoclassical economics relies on models to explain supply and demand among individuals who are assumed to make rational decisions to maximise their utility based on income. In informal settlements, however, the study has shown that such models do not wholly explain payment for sanitation, as other factors such as relationships and norms also explain the demand for sanitation. In addition, individuals do not always make decisions for sanitation based on costs/income. Realising this gap, the study then borrowed from the New Institutional Economics, which focuses on group behaviour, to further understand the socio-economic dynamics in informal settlements that determine the continued use of shared sanitation. Combining the neoclassical and heterodox economics discourses led to complementarity as well as a holistic understanding. Such a stance of combining neoclassical and heterodox economics is shared by Holt *et al.* (2011), who propose the working together of various economic strains because economics is progressing towards the complexity era. Similarly, in a willingness to pay study in Tanzania, Milanesi (2010) noted that important theoretical outcomes can result by combining various branches of economics. The main message contained in this dissertation therefore is that, in informal settlements, sanitation is an issue embedded in the residents' everyday socio-economic dynamics, which require various individuals, research approaches and disciplines.

8.5 Contributions of the study

8.5.1 Theoretical contributions

Overall, this study provides information on sanitation in Kisumu, and thus contributes to the lack of data on sanitation in Kisumu's informal settlements.

The study is the first (to the best of my knowledge) to use the revealed preference method, specifically the hedonic pricing method, in Kisumu's informal settlements. In addition, the study has estimated the cost of sanitation as reflected through rental prices in the settlements, while also highlighting the limitations that the neoclassical economics approach is faced with in informal settlements.

Whereas the CPR management principles have been used in other fields, this study has adopted the principles to investigate the determinants of quality of shared sanitation facilities, leading to an understanding of strategies for the sustained use of shared sanitation facilities in informal settlements. The dissertation has therefore contributed to the literature on co-production and common pool resource management by applying a case study to these theories. The thesis has shown the applicability of the CPR principles in sanitation, and highlighted that the principles are interrelated. Emergent is that some principles are primary (such as boundary definition of the sanitation facility as well as the users), and once the primary principles are in place, then other principles will fall in place or require less effort (for example, once a shared facility is situated in a fenced compound, then the users need little monitoring).

Still on economic schools of thought, decision making and choices made by individuals, this dissertation has contributed to the literature that economic models are not enough to understand the nuances of why and how decisions get made as they do. The study has led to an elaborate illustration of how decision making for sanitation occurs among households in informal settlements. The important contribution is that the illustration from this study has covered some fundamental questions (what, how, who, why) by outlining the types of sanitation decisions made, how these decisions are made, the individuals making these decisions, and reasons for making these decisions. Previous studies have contained little or none of such socio-economic dynamics of sanitation especially in a complex environment such as informal settlements.

Finally, the study has demonstrated that it is possible to combine the neoclassical and heterodox economic schools of thought for an in-depth and holistic understanding of a complex matter such as sanitation.

8.5.2 Methodological and practical contributions

Although various research strategies have been applied to study sanitation in informal settlements, this study incorporated theatre/role play as part of the methods to facilitate the discussions of sanitation practices among residents. The use of theatre/role play broke barriers that would normally be encountered when investigating topics such as sanitation among the urban poor living in an informal settlement.

The study also adopted principles of participatory and transdisciplinary research to involve stakeholders in the co-production of knowledge in sanitation. These stakeholders were drawn from various disciplines to discuss sanitation matters. Such involvement of stakeholders demonstrated that it is possible to work together and arrive at a solution to a complex problem. Such participatory approaches can be used by researchers and other stakeholders in development.

In summation, theoretically and methodologically, this dissertation has emphasised that sanitation is an important aspect of people's day to day lives, and it is especially crucial for those living in informal settlements who are challenged by poor living conditions. Therefore, in addition to the important role played by informal settlements, this study has demonstrated how sanitation improvement in informal settlements could begin. It begins by recognising the important, albeit subtle, socio economic aspects in informal settlements that affect sanitation. Tackling these aspects requires cooperation and involvement of all stakeholders using participatory and ingenious approaches that will then bring out the hidden socio economic aspects.

8.6 Policy recommendations

As it has been discussed that informal settlements are an important aspect of urban centres, urban policy makers, especially in Kisumu, which is estimated to have the highest proportion of urban dwellers in Kenya, may consider alternatives to improvement in service delivery. Development efforts therefore should encompass several areas of need and in the case of Kisumu's informal settlements, these may include improvements in sanitation as well as opportunities for the involvement of residents.

This dissertation has identified that there are various social and economic dynamics within informal settlements that affect the residents' day-to-day lives. Governments should thus ensure that they are equipped with human and financial resources that promote the positive aspects of informal settlements. Avenues for engagement with informal settlements should then be identified and promoted. These engagements should bring out the deeply entrenched and positive socio economic aspects within the settlements.

One way of engagement is to liaise with residents as well as stakeholders in disciplines such as public health, engineering, social science, urban planning and economics, all of whom are in one way or the other involved in sanitation. Involving these stakeholders will lead to collaborative decision making and the discovery of alternative approaches to development. Residents can use the leaders of their community groups as agents and middle men between the stakeholders and community members.

For sanitation in particular, the county governments could liaise with landlords (especially absentee landlords), who are providers of sanitation to ensure that tenants have access to sanitation facilities, even if it includes financial assistance to these landlords. Policy makers should also cooperate with the residents of informal settlements to establish by-laws that ensure that residents in the settlements have access to sanitation facilities that are clean. Establishing by laws through cooperation with residents ensures that the strategies that are devised are workable, bearing in mind the dynamics of sharing sanitation facilities.

Finally, during their course of inspecting sanitation facilities, government public health officers should consider assessing the cleanliness of sanitation facilities and consider working with local leaders to monitor these facilities.

8.7 Recommendations for further research

Some concerns have been raised from this study that could be avenues for further research.

It would be crucial to identify sanitation technologies that are appropriate, affordable, and that can be adopted in Kisumu's informal settlements. Such an assessment requires the involvement of other disciplines such as engineering and economics. Research should also investigate the minimum number of users who can successfully work together to ensure that facilities are kept clean and hygienic for use. Since provision and management form just one aspect of the sanitation chain,

further research ought to be carried out to identify possible avenues for the management of the faecal sludge, and whether these avenues can be opportunities for using human waste as a resource or income-generating activity in informal settlements. Studies on decision making among households in other informal settlements can be carried out to determine how different or similar the decision-making process is to that suggested by this study. Finally, it would be beneficial to investigate how technological advancement can be incorporated into designing an appropriate sanitation intervention.

8.8 Final conclusion

In the introductory chapter it emerged that, as the SDG period begins, there is a need to understand *who* lacks sanitation, *why* they lack sanitation, *what* can be done about it, and *how*. This study has identified the various socio-economic factors that hinder access to sanitation (the *'why'*) among the urban poor (the *'who'*), and has also identified approaches that can be used to increase access to sanitation (the '*what and how*') in informal settlements (the '*where*'). In these informal settlements, sanitation is an issue embedded in residents' everyday lives, affecting their choices, relationships and general way of life. Adequacy of sanitation in informal settlements can be achieved when residents work together to ensure that each household can at least access a sanitation facility. Landlords and tenants both need each other, and each one should ensure that the (sanitation-related) needs of the other are met. Individuals and stakeholders therefore should not work for their self-interest per se, but rather for the common good.

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10. APPENDICES

APPENDIX 1: CONSENT FORMS

UNIVERSITEIT•STELLENBOSCH•UNIVERSITY
jou kennisvennoot • your knowledge partner

STELLENBOSCH UNIVERSITY
CONSENT TO PARTICIPATE IN RESEARCH

SOCIO ECONOMIC DYNAMICS OF SANITATION IN INFORMAL SETTLEMENTS OF KISUMU, KENYA

You are asked to participate in a research study conducted by Sheillah Simiyu who is a student from the School of Public Leadership at Stellenbosch University. This research is purely for academic purposes and results will not only culminate in a research thesis, but also research papers accessible to the public.

You were selected as a possible participant in this study because you are a resident in this area.

1. PURPOSE OF THE STUDY

The study is intended to examine socio economic dynamics of sanitation in informal settlements of Kisumu.

2. PROCEDURES

If you volunteer to participate in this study, we will ask you to give us your opinion to the questions we will ask, which will take approximately twenty minutes.

If there is a sanitation facility in your compound, we will ask for your consent for us to inspect it after this interview

OR,

We will engage you in a discussion, which will also take approximately one hour

3. POTENTIAL RISKS AND DISCOMFORTS

This study does not pose any risks, discomforts, or inconveniences to you, except taking your time as you give us your opinion/response

4. POTENTIAL BENEFITS TO SUBJECTS AND/OR TO SOCIETY

This study may not directly benefit you. However, it is expected that the research will lead to an understanding of socio economic dynamics of sanitation in informal settlements. Recommendations that will be of benefit to stakeholders working in the informal settlements, and should they implement them; they will benefit residents of informal settlements.

5. PAYMENT FOR PARTICIPATION

By Participating in this study, you will not receive any payment or remuneration.

6. CONFIDENTIALITY

Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission or as required by law. In order to maintain Confidentiality, we will not write your name anywhere in this questionnaire, but will instead use unique identifiers, so that the information is not linked to you in any way. All completed questionnaires will be kept away from all unauthorized personnel by keeping them locked from the general public, and afterwards stored in securely locked computers. Only the researchers will have access to this data.

When the results are finally published and released to the public, they will not be linked to any one individual, but will rather be presented as general results for the study

7. PARTICIPATION AND WITHDRAWAL

You can choose whether to be in this study or not. If you volunteer to be in this study, you may withdraw at any time without consequences of any kind. You may also refuse to answer any questions you don't want to answer and still remain in the study.

8. IDENTIFICATION OF INVESTIGATORS

If you have any questions or concerns about the research, please feel free to contact Sheillah Simiyu on ----------

9. RIGHTS OF RESEARCH SUBJECTS

You may withdraw your consent at any time and discontinue participation without penalty. You are not waiving any legal claims, rights or remedies because of your participation in this research study. If you have questions regarding your rights as a research subject, contact Ms Maléne Fouché [mfouche@sun.ac.za; 021 808 4622] at the Division for Research Development.

SIGNATURE OF RESEARCH SUBJECT OR LEGAL REPRESENTATIVE

To delete where appropriate:

The information above was described to [*me/the participant]* by in [*English/Swahili/Dholuo]* and [*I am/the participant is]* in command of this language or it was satisfactorily translated to [*me/him/her*]. [*I/the participant/]* was given the opportunity to ask questions and these questions were answered to *[my/his/her]* satisfaction.

[I hereby consent voluntarily to participate in this study/I hereby consent that the subject/participant may participate in this study.] I have been given a copy of this form.

_____

Name of Subject/Participant

_____

Name of Legal Representative (if applicable)

_____ _____

Signature of Subject/Participant or Legal Representative **Date**

SIGNATURE OF INVESTIGATOR

I declare that I explained the information given in this document to _____ and/or [his/her] representative _____ *[He*/she] was encouraged and given ample time to ask me any questions. This conversation was conducted in English/Swahili/Dholuo and [*no translator was used/this conversation was translated into* _____ by _____].

_____ _____

Signature of Investigator **Date**

APPENDIX 2: HOUSEHOLDS INTERVIEW SCHEDULE

Study Code..... **Date.....**

Area..... **Unit.....**

Interviewer.....

Checked and verified by..... **Date.....**

Section A: Respondent characteristics

1. Gender
   [1] Male [2] Female

2. Age (completed years)

3. Religion
   [1] Muslim [2] Christian
   [3] Other

4. Education level (completed)
   [1] None [2] Primary completed
   [3] Primary Incomplete [4] Secondary Complete
   [5] Secondary Incomplete [6] College

5. Marital Status
   [1] Single (not married)
   [2] Single parent [3] Married
   [4] Widowed [5] Divorced/Separated

6. Occupation
   [1] None/Housewife [2] Fisherman
   [3] Casual worker [4] Self-employed
   [5] Formal employment
   [6] Other (Specify)

7. Where do you work?

8. [If applicable] What is your spouse's occupation?
   [1] None [2] Fisherman
   [3] Casual worker [4] Self-employed
   [5] Formal employment
   [6] Other (Specify)

9. Where does your spouse work?

10. Income per month (Ksh) *(income means monthly salary and all other sources of income including business, rentals etc.)*

11. Number of people in your house/Total Household size: ---------

	Person	**Relationship**	**Age**
1			
2			
3			
4			
5			
6			
7			
8			

Section B: House Characteristics

1. How long have you lived in this house?

2. What factors attracted you to live in this house/what do you like about this house?

3. How many rooms are in your house?

4. Do you have electricity connection?
   [1] Yes [2] No

5. If You have electricity connection, how much do you pay for electricity in a month? (Please probe)

6. How much do you pay for rent per month?

7. What does this amount cover apart from rent? (e.g. electricity, water, etc. please probe)

Section C: House characteristics to observe and note:

1. Roofing materials
[1] Iron sheet
[2] Thatched roof
[3] Other (Specify)

2. Floor materials
[1] Mud/earthen [2] Cemented
[3] Concrete [4]Tiles
[5] Other (specify)

3. Wall
[1] Mud [2] Iron sheet
[3] Rough Cast
[4]Plastered/concrete
[5] Other (Specify)

Section D: Compound Characteristics

1. Total number of households in the compound: .....

	Rent category	**No of HH**
1		
2		
3		
4		
5		
6		

2. What is your primary/main source of water?

[1] Compound Connection [2] Nearby Kiosk
[3] Nearby Water point
[4] Neighbours compound
[5] Communal facility [6] Spring
[7] Borehole [8] Other (specify)

3. [If applicable] What is your secondary source of water?

[1] Nearby Water point [2] Spring
[3] Communal facility
[4] Neighbours compound
[5] Borehole [6] Other (specify)
[7]Neighbouring Industries

4. How long does it take you to walk to the primary water source?

5. How long does it take you to walk to the Secondary water source?

6. Is the primary water source available whenever you need it?
[1] Yes [2] No

8. Is the Secondary water source available whenever you need it?
[1] Yes [2] No

7.If No, state reason:

9.If No, state reason:

10. How much do you pay for water at the primary water source?

11. How much do you pay for water at the secondary water source?

12. Is there a toilet in the compound?
[1] Yes [2] No
(*If Yes, please ensure to inspect it*)

13. Do You use it? [1] Yes [2] No

14. If Not used, Please explain why:
[1] It is full [2] It needs repair (explain)
[3] It is locked [4] Other (specify)

15. If there is No toilet, where do you relieve yourself?
[1] Neighbour's toilet [2] Communal toilet
[3] Bio Centre [4] Bush
[5] Flying toilet [6]Other (specify)

16. What costs (if any) related to the toilet do you pay as a tenant, and how much? (These could include construction costs, costs of repair, costs of emptying...probe further)

17. Where do you dump your waste?
[1] In the compound-no designated area
[2] In the compound-designated area
[3] Outside the compound [4] Disposal bags
[5] Other (Specify)

18. What costs (if any) related to waste disposal do you pay, and how much? (Please probe and specify)

19. What security measures are in place?

20. Do you have a Landlord living in the compound?
[1] Yes [2] No

21. Do you have a Caretaker living in the compound?
[1] Yes [2] No

Section E: Compound characteristics to observe and note:

1. Security measures in place
(*Look out for fence, gate, or any barrier to keep off intruders and note it*)

2. Type of residence
[1] Tenants living with landlord
[2]Tenants living with caretaker
[3]Tenants living alone
[4]Other (specify)

Section F: Neighbourhood Characteristics

1. How long does it take you to walk to the nearest access road?

2. If Inaccessible by foot, what form of transport do you use?
[1] Boda Boda [2] Motor bike
[3] Tuk Tuk [4] Other (Specify)

3. How long does it take you?

4. How long does it take you to walk to the main road?

5. If Inaccessible by foot, what form of transport do you use?
[1] Boda Boda [2] Motor bike
[3] Tuk Tuk [4] Matatu
[5] Other (Specify)

6. How long does it take you?

7. Where do you purchase your daily supplies (e.g. grocery)

[1] Stalls/shops in the neighbourhood
[2] Kibuye market
[3]Other (Specify)

8. How long does it take to walk?

9. If inaccessible by foot, what form of transport is used?
[1] Boda Boda [2] Motor bike
[3] Tuk Tuk [4] Matatu
[5] Other (Specify)

10. How long does it take you?

11. Where do your children go to school and how long does it take to walk to school?

Child	School	Time taken to walk to school	If inaccessible transport used	Time taken with other transport
1				
2				
3				
4				
5				
6				

12. (If Applicable) How long does it take to your place of work?

13. By what form of transport?
[1] walking on foot [2] Boda Boda
[3] Motor bike [4] Tuk Tuk
[5] Matatu [6] Other (Specify)

14. (If Applicable) How long does it take to your spouse's place of work?

15. By what form of transport?
[1] Walking on foot [2] Boda Boda
[3] Motor bike [4] Tuk Tuk
[5] Matatu [6] Other (Specify)

16. How long does it take to town/CBD?

17. By what form of transport?
[1] Walking on foot [2] Boda Boda
[3] Motor bike [4] Tuk Tuk
[5] Matatu [6] Other (Specify)

18. What health facility do you/your household use?

19. How long does it take you to the health facility

20. By what form of transport?
[1] Walking on foot [2] Boda Boda
[3] Motor bike [4] Tuk Tuk
[5] Matatu [6] Other (Specify)

21. Are there any environmental risks/challenges you face in your neighbourhood? Please explain

Section G: Living Conditions challenges

What challenges, related to your house, compound or neighbourhood do you face?

APPENDIX 3: SANITATION INSPECTION TOOL

Date: ---------- **Area:** ----------
Unit: ---------- **Study Code:** ----------
Inspected by ----------
Checked and verified by---------- **Signature**----------

4. Sanitation facility

Type of toilet:	***Location:***	***Construction materials:***
[1] Pit latrine [2] EcoSan toilet [3] Flush toilet to sewer line [4] Other	[1] Outside the Compound [2] Within the plot/compound [3] A distance from the plot/compound [4] At the neighbours' plot/compound NB: Estimate length of time taken	Roofing: [1]Iron sheet [2] Wattle [3] None/No roof Superstructure: [1] Iron sheet [2] Bricks/Stone [3] Wood [4] Mud [5] Other Floor: [1] Wood [2] Mud [3]Slab [4] Other

5. User factors

Cubicle	Users	No of HH sharing	No of users	Rent range	Inspected	Remarks
1						
2						
3						
4						

Key for users
[1] Owners and tenants [2] Tenants and caretaker [3] Tenants only [4] Owner, tenants and neighbours [5] Tenant, caretaker, and neighbours [6] Others: Specify

6. Hygiene factors

	Yes	No	Other
Is there faecal matter on the slab?			
Are there flies in the facility?			
Is there a smell from the facility?			

7. Privacy factors

	Yes	No	Other
Does the facility have a door?			
Can the door be locked? i.e. does it hold in place?			
Does the door have a locking latch?			
Does the door offer privacy? i.e. no cracks			
Does the facility have a complete superstructure?			
Does the superstructure offer privacy? i.e. no cracks on the superstructure			
Does the facility have a roof?			
Does the roof offer privacy, i.e. no cracks?			

8. The slab and other visible factors

	Yes	No	Other
Are there cracks/visible spaces on the slab?			
Is the drop hole too big? (bigger than the size of a foot)			
Is the drop hole open? (no evidence of a cover)			
Are there standing fluids on the slab?			
Is the facility full?			
Is the facility semi full?			

Is there a hand washing facility nearby? (Specify)

Any visible signs of poor construction: Specify

Rate the cleanliness of the facility: [1]: very clean [2]: Clean [3]: Dirty

[4]: Very dirty

History of use:

How long has the facility been in use?

Has the facility ever needed repair? [1] Yes [2] No

What steps were taken?
[1] Inform the land owner
[2] Inform the caretaker
[3] Contribute towards repair
[4] Wait for the land owner to act
[5] Others:

Has the facility ever needed emptying? [A] Yes [B] No

What steps were taken when it needed emptying?
[1] Contribute towards emptying
[2] Inform the land owner
[3] Inform the Caretaker
[4] Wait for the land owner to act
[5] Others:

Other Remarks:

APPENDIX 4: SHARED SANITATION MANAGEMENT INTERVIEW GUIDE

ID number..... **Date**.....

Slum..... **Unit**.....

Compound details to observe:

Indicate the type of residence in the compound: [A] Own compound with several household family members [B] Owner living with tenants [C] Tenants living with land agent [D] Tenants with absent landlord	**Respondent:** Gender of respondent
Observe if there is anything that defines the compound boundaries: e.g. fence Number of households in the compound:	Type of toilet: Number of toilet cubicles Observe if the toilet is locked

How many households share each cubicle/facility?

How often is the toilet used?

Who are the main users of the toilet? (Probe for men, women, children, outsiders)

How do other users (apart from compound members) get access to use the toilet? (Probe for agreement with landlords, getting permission, getting a key, paying, etc.)

What steps are taken to keep off outsiders/illegitimate users from using the toilet?

Why is the toilet locked/not locked?

How do users get access to the toilet?

How do users contribute to the maintenance of the toilet? (Probe for cleaning, paying for cleaning, contributing to buy broom or cleaning materials, etc.)

What is done to ensure that all users contribute to the maintenance of the toilet?

Can all users be trusted to ensure that they play their role towards the maintenance of the toilet?

Who cleans the toilet, and how often is this done?

What steps are taken to ensure that cleaning is done (probe for duty rota, landlord monitoring, etc.) and is this method effective?

What rules are in place for use of the toilet?

Who formulated these rules, and how?

Are the rules effective?

How are you involved in the formulation and changing the rules?

How are decisions concerning the toilet made?

What happens when these rules need to be altered or if there are issues about the toilet that need to be discussed?

What happens when users do not comply with rules? (Probe for punishment)

Who is in charge of ensuring that the toilet is kept in good condition, and how does he do it?

What conflicts do you face concerning the use of toilet?

How are such conflicts resolved?

What challenges do you face concerning the toilet?

APPENDIX 5: DECISION MAKING IN KISUMU'S INFORMAL SETTLEMENTS: INTERVIEW GUIDES

LANDLORDS' INTERVIEW GUIDE

Study Code..... **Date**.....

Area..... **Unit**.....

Interviewer..... **Checked and verified by** .....

NB: Do the necessary introductions, scene setting, conversation striking, etc. before beginning the interviews

Section A: Compound details

Indicate the type of residence in the compound:

[1] Resident owner living with tenants
[2] Resident owner without tenants
[3] Absentee landlord
[4] Other:

Respondent Gender:

[1] Male

[2] Female

Number of households in the compound:

1. [For compounds without a toilet] Have you had a toilet before?	
2. If **yes**, what happened? (ask for factors that led to not having a toilet, and where they relieve)	
3. If you have NEVER had a toilet, have you considered constructing one?	
4. If not, why not?	
5. Are you likely to construct a toilet?	
6. If not, why not?	
7. What would influence your decision to construct/repair a toilet?	
8. Would you consult anyone? If so, whom would you consult?	
9. Anyone within your household?	
10. Why this person(s)?	

11. Would you consult your tenants? Why, how and for what reasons?	
12. As a landlord, what decisions would you make concerning management of the toilet? E.g. repair and emptying?	
13. What decisions would you let your tenants make concerning the toilet? And why?	
14. How do they make these decisions?	
15. What payments would you require tenants to pay that are related to the toilet?	
16. If you were to rank your preferred toilet types, what would these be? (Beginning from the most preferred to the least preferred)	
17. Why in that order?	
18. What hinders/prevents you from having your preferred toilet?	
19. According to you, what are the three most important qualities of a toilet?	Most important Second important Third important
20. Why these three?	

TENANTS' INTERVIEW GUIDE

Study Code..... **Date**.....

Area..... **Unit**.....

Interviewer..... **Checked and verified by** .....

NB: Do the necessary introductions, scene setting, conversation striking, etc. before beginning the interviews

Section A: Compound details

Indicate the type of residence in the compound:
[1] Resident landlord living with tenants
[2] Tenants living with Caretaker
[3] Tenants with absent landlord
[4] Other:

Respondent:
[1] Tenant living with the landlord in compound
[2] Tenant living with caretaker
[3] Tenant living without caretaker or landlord

Gender:
[1] Male
[2] Female

Number of households in the compound:

1. [For compounds without a toilet] Have you had a toilet before?	
2. If **Yes**, what happened? (ask for factors that led to them not having a toilet, and where they relieve)	
3. What decisions were made about this toilet, and by whom?	
4. Were you involved in the decision making/Did you participate? Why?	
5. Have you as a tenant considered constructing a toilet?	
6. If not, why not?	
7. What would influence the decision to construct a toilet?	
8. Would you/the landlord consult anyone? Whom, and why? (Probe about household members or other tenants, etc.)	
9. Do you/Have you ever as tenants, repaired the toilet?	
10. Do you/would you consult anyone? Who?	

Why, how and for what reasons?	
11. As tenants, what decisions do/would you make concerning management of the toilet? E.g. repair and emptying?	
12. How would you make these decisions?	
13. What payments would/do you as tenants pay that are related to the toilet?	
14. How is this decision arrived at?	
15. If you were to rank your preferred toilet types, what would these be? (Beginning from the most preferred to the least preferred)	
16. Why in that order?	
17. What hinders/prevents you from having your preferred toilet?	
18. According to you, what are the three most important qualities of a toilet?	Most important Second important Third important
19. Why these three?	

ABSENTEE LANDLORDS' INTERVIEW GUIDE

NB: Do the necessary introductions, scene setting, conversation striking, etc. before beginning the interviews

1. How many plots and tenants do you have?
2. Why did you decide not to be a resident land owner/live away from your tenants?
3. How do you monitor your property, since you live away?
4. How much rent do they pay? And why do they pay different rates?
5. What factors would lead to an increase in their rent prices?
6. Do you consult anyone when making decisions about these rentals?
7. Who do you consult, and what particular decisions?
8. Do these tenants have a toilet in the compound?
9. Have they had a toilet before?
10. Why do they not have a toilet now?
11. Where do they relieve themselves?
12. What arrangements were put in place for them to relieve themselves here?
13. How were you involved in this decision?
14. What decisions regarding the toilet do you let the tenants make?
15. What decisions do you make concerning the toilet?
16. What payments related to the toilet do the tenants make?
17. Whom do you consult on matters related to the toilet?
18. What challenges, related to the rentals, do you face as a landlord who lives away from tenants?

APPENDIX 6: DECISION MAKING FOR SANITATION IN KISUMU'S INFORMAL SETTLEMENTS: FGD GUIDES

RESIDENT LANDLORDS (WITHOUT SANITATION) FGD GUIDE

1. Have you had a toilet before?
2. If **Yes**, what happened? (ask for factors that led to them not having a toilet, and where they relieve)
3. If you have NEVER had a toilet, have you considered constructing one? Why?
4. Are you likely to construct a toilet? Why?
5. Where do you relieve yourself, and how did you decide to use this place?
6. What would influence your decision to construct a toilet?
7. If you decided to construct a toilet, would you consult anyone? Who and Why?

Questions 7-10 apply if the landlords have tenants

8. Would you consult your tenants? Why? How?
9. As a landlord, what decisions would you make concerning management of the toilet? E.g. repair and emptying
10. What decisions would you let your tenants make concerning the toilet? And why?
11. What payments would you require tenants to pay that are related to the toilet?

Continuation

12. What type of toilet would you prefer and why? (Let them mention three most preferred and reasons for choice)
13. According to you, what are the three most important qualities of a toilet, and why?

RESIDENT LANDLORDS WITH SANITATION FGD GUIDE

1. How many tenants are in your compounds?
2. How many toilet cubicles do you have?
3. Have your toilets ever needed repair/emptying, and what action was taken?
4. What duties concerning the toilets, are you as the landlord responsible for?
5. What duties are the tenants responsible for?
6. How do you make these decisions?
7. What decisions do tenants make concerning the toiler?
8. How are these decisions made?
9. What toilet related costs do tenants pay?
10. What type of toilet would you prefer, and why?
11. According to you, what are the three most important qualities of a toilet, and why?

TENANTS WITH SANITATION FGD GUIDE

1. How many households are in your compounds?
2. How many toilet cubicles do you have?
3. What duties, concerning the toilet, are you as tenants responsible for?
4. What duties is the landlord responsible for?
5. What decisions do you as tenants make that concern the toilet?
6. How do you make these decisions?
7. Have your toilets ever needed repair/emptying?
8. What action was taken, and who made these decisions?
9. How were these decisions made?
10. Who is responsible for cleaning the toilet?
11. How was this decision made?
12. What toilet related costs do you as tenants pay?
13. How is this decision arrived at?
14. What type of toilets would you prefer as tenants, and why?
15. According to you, what are the three most important qualities of a toilet, and why?

TENANTS WITHOUT SANITATION FGD GUIDE

1. How many households are in your compounds?
2. Have you had a toilet before?
3. Why don't you have a toilet now, and for how long have you not had a toilet?
4. Where do you relieve yourself?
5. Who made this decision to relieve yourself at this place, and how?
6. Was the landlord involved in this decision, and how?
7. What toilet related duties are your responsibilities at the place of relief?
8. How was this decision arrived at?
9. What decisions do you as tenants make that concern the toilet?
10. How do you make these decisions?
11. Who is responsible for cleaning the toilet?
12. How was this decision made?
13. What toilet related costs do you as tenants pay?
14. How is this decision arrived at?
15. What type of toilets would you prefer as tenants, and why?
16. According to you, what are the three most important qualities of a toilet, and why?

CARETAKERS' FGD GUIDE

1. What responsibilities do you have as the caretaker in your compound/plot?
2. What decisions do you as the land agent/caretaker make that concern the toilet?
3. How do you make these decisions?
4. How is the landlord involved in toilet matters/decisions in your compounds?
5. Have your toilets ever needed repair/emptying?
6. What decisions were made, and who made these decisions?
7. Who is responsible for cleaning the toilet?
8. How was this decision made?
9. What toilet related costs do the tenants in your compounds pay?
10. How is/was this decision arrived at?
11. As land agents, what type of toilets would you prefer, and why?
12. According to you, what are the three most important qualities of a toilet, and why?

APPENDIX 7. PHOTOS OF SANITATION FACILITIES IN KISUMU'S INFORMAL SETTLEMENTS

1. Superstructure

a. Wood and iron sheet for the superstructure, no roofing

b. Plastered bricks/stone for the superstructure

2. Slab

a. Wooden slab, with a partition as a drop hole

b. Clean slab, with brick superstructure

c. Dirty and full toilet